metal finishing

APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, METAL SPRAYING and all METAL FINISHING PROCESSES

Vol. 4 No. 39 (new series) MARCH, 1958

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metal finishing Journal

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THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

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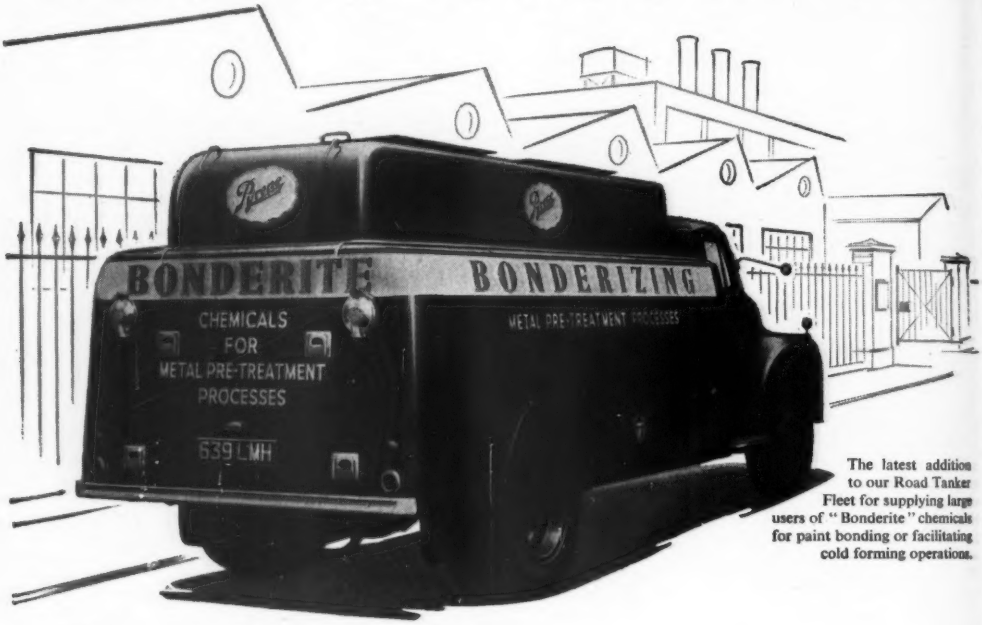

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MORE FROM LESS

THE two most significant costs in relation to commercial metal finishing practice are capital equipment and labour. This state of affairs is not, of course, peculiar to the metal finishing industry but applies generally to the majority of industrial processes. It is therefore, in the best interests of economic working that every effort be made to obtain the maximum output possible from expensive capital equipment and from highly paid operatives.

This apparently obvious concept has in recent years been distinguished by being given the definitive title of " productivity," and a considerable amount of investigation and discussion has been and is being devoted to the subject. In view of the very broad criteria which are involved in productivity considerations, it frequently happens that general principles can be established which apply eith equal force to a wide range of quite different industries whose technical and commercial aspects have little or nothing in common.

Because of this fact, and also because writers on productivity have found it necessary to evolve their own technical jargon, there has been a tendency to dismiss many of the findings of productivity study as the impractical vapourings of long-haired theorists with no real knowledge of the fundamental needs and problems of industry. Productivity and its hand-maiden work study have thus come to be regarded in many quarters with the same sort of general suspicion as has been accorded to such other new sciences as psychology and sociology.

It is perhaps inevitable in the early formative years of a new science of technique, particularly where this has to deal largely with intangibles and abstruse concepts, that there should be a certain amount of loose thinking and writing, a number of exaggerated claims, and even some out and out charlatanism, but most of this goes quickly to the wall when the concepts are put to the test of practical application.

There is a natural reluctance on the part of management to admit that the efficiency of the processes and methods for which it is responsible is susceptible to any marked improvement, and anyone who claims to be able to increase the output from a given plant or labour force, is apt to be regarded as being out of touch with reality or a slave driver, or perhaps both. Such being the case, it is understandable that productivity theory is slow in finding acceptance. Nevertheless, there is an accumulating body of evidence that the level of productivity of a very large number of production units in this country is well below the maximum.

Elsewhere in this issue we publish a brief note describing some of the work of the Productivity Advisory Service initiated by the Hot-Dip Galvanizers Association. From the evidence of case histories relating to this comparatively small and specialized industry, work study and its investigational techniques have been able to effect substantial increases in output from existing or even reduced labour and equipment resources. The significance of some of the findings is high-lighted in a film produced in collaboration with the British Productivity Council which illustrates some of the methods and techniques employed in work study. The effective application of these techniques has been able to demonstrate incontrovertibly that even where a team of men appeared to be fully occupied for all of their time, in fact, the labour utilization might well be at a considerably reduced percentage of the maximum potential.

In the light of this evidence there is a very strong case for taking a long and critical look at much of our present works practice.

Talking Points

by "PLATELAYER"

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

TIME IS MONEY

THE most common criticism one hears about British products abroad is delivery; either excessively long deliveries are quoted, or if this is not the case, delivery promises are not kept. It is certain that this was the case a few years ago, but with improvements in raw material supplies and labour, deliveries are much better. However, when a country — or a company — acquires this kind of reputation it takes a long time to live down. Today, as often as not delivery time is as important as price, and is very largely a matter of good management. As long ago as 1811 Sir John Throckmorton won a thousand guinea wager that he would dine in a well-made suit of clothes which at five o'clock that same morning was fleece on the backs of two sheep. This was indeed a masterpiece of organization, involving a multitude of trades, from shearers and carders to weavers, dyers and tailors. Could it be done today ?

POPULAR FALLACY

WITHOUT wishing to enter into the controversy on the relative merits of infra-red and convection heating for paint stoving which is now going on in the pages of certain publications, I am disturbed to find that in a recent article emanating from a prominent electrical company the statement is made that "since the surrounding air plays only a minor part in heat transfer in radiant heating, an enclosure is not absolutely necessary . . "

I was under the impression that this misconception no longer existed, but in this I was apparently mistaken. When infra-red ovens using electric lamps were first introduced during the war, these were in fact mounted on a frame on each side of a conveyor carrying the articles to be stoved without any enclosure at all. Everything went swimmingly, until a cold spell arrived, when it proved impossible to dry the enamel. It was only by hurriedly throwing tarpaulins over the infra-red installations that they were made to operate at all, albeit inefficiently.

Apparently, what the physicists who introduced infra-red stoving had forgotten was that although it is true that the lamps transfer their heat to the work almost entirely by radiation, the work itself is transferring its heat to the surrounding air all the time — almost entirely by convection !

If the air is very cold, therefore, the articles being stoved will be cooled by the draught as fast as they are being heated by the radiant source.

It is quite extraordinary that such an elementary fact should have been so completely overlooked, and the literature is full of papers which have ignored the influence of the temperature of the surrounding air on the rate of heating up of articles by radiant heat.

Of course, good infra-red ovens should be insulated just as well as convection ovens, and for the same reason.

CYNIC'S VIEW

IT is interesting to see that a "non-technical" course on atomic energy is to be run at Harwell especially for directors. The course will give directors a grounding in atomic theory and, as the sponsors state "will enable them to assess for themselves the value of suggestions put to them by their technicians."

This is, indeed, an alarming development for technicians, whose main consolation lies in the fact that they generally have to deal with directors whose technical knowledge is, to say the least, somewhat limited. Normally, directors ask their technicians to tell them as simply as possible what they propose to spend on, say, a new development, and what benefits are going to result from this expenditure. If the difference is adequate and the money available, they can go ahead.

If this idea of bringing technical education into the realms of business proceeds much further, a plater may yet find himself being asked by his bank manager whether he is going to use pyrophosphate or cyanide copper plating on his products, before he is granted an overdraft !

TAXING THE SCIENTIST

SPEAKING at Glasgow on "Russian Scientific Institutions" recently, Prof. J. Monteath Robertson commented on the fact that in Russia when a scientist is elected to the Academy of Sciences he is paid a tax-free salary for life. He then went on to say — "The situation is in marked contrast to that which pertains here where upon election to a learned society or Academy an annual subscription is exacted." He might have gone further and pointed out what is even worse, *i.e.*, that the subscription is not normally chargeable against income tax as an expense. However, I suppose we should be grateful for the fact that (so far) most of the scientific institutes are exempted from income tax.

Automation of a BARREL PLATING LINE

A description of a new automatic independent-cycling plant for the deposition of cadmium installed in a U.S. works.

THE entire cadmium barrel plating line of the Bellevue Plating Co. at Detroit was designed with one basic principle in mind : material had to be handled as rapidly and efficiently as possible without any loss of quality. This meant that peak period bottle-necks had to be eliminated, storage of raw or plated parts cut to a minimum, and the plating operation speeded up. Because of the highly competitive nature of the business and the rigid standards specified by the parent company, the National Machine Products Co. of Utica, Michigan, quality control was as essential as high speed.

When this new cadmium line was added recently, engineers of the Hanson-Van Winkle-Munning Company of Matawan, New Jersey, were asked to supply five features for barrel plating : (1) The utmost flexibility so that rapidly changing plating requirements would not disrupt operations ; (2) automation to cut manual labour costs and eliminate chances for error ; (3) a method of mechanized materials handling to reduce time between operations ; (4) solutions that would stand up under high current densities ; and (5) a machine that would remove the guesswork from the plating operation.

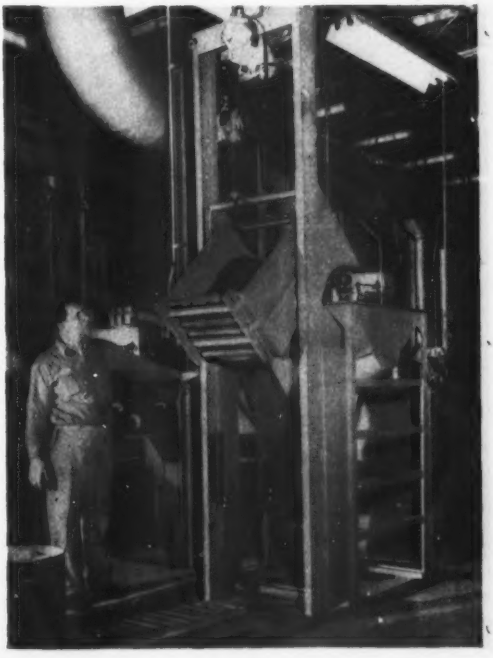
Of the five, the flexibility was the most important, since Bellevue might run as many as 30 different parts through the machine in one shift. A method had to be devised that would provide adjustable plating cycles — and be so flexible that each barrel would be able to follow its own cycle, independent of the others.

One of the answers supplied by Hanson-Van Winkle-Munning was a two-speed machine that would allow an output of either 23 or 36 barrels per hour. This feature permits adjusting the loads in progress to the backlog in the dispatch room, without calling for the inefficient method of alternating high speed with complete shutdowns, or permitting pile-ups during past peak periods.

Bellevue's operations are complicated not only by the various types of small parts that must be plated in one shift, but by the fact that some are cleaned and plated, while others are only cleaned. This requires following one load with another that has an entirely different cycle. Hanson-Van Winkle-Munning solved this problem by installing their highly flexible Dial-A-Cycle system on the machine.

The Dial-A-Cycle principle is one of completely automated cycling for each barrel, independent of all others. This cycle is selected by the machine operator as he loads the barrel. Each carrier arm has eight flags that are designed to trip limit switches at certain stations on the machine, the operator setting the flags to give the cycle required by the load.

Fig. 1.—Mechanical lift raises can of parts from roller conveyor to storage hopper. The conveyor brings parts directly from dispatch room to the cadmium plating line at the Bellevue Plating Company's Detroit plant.



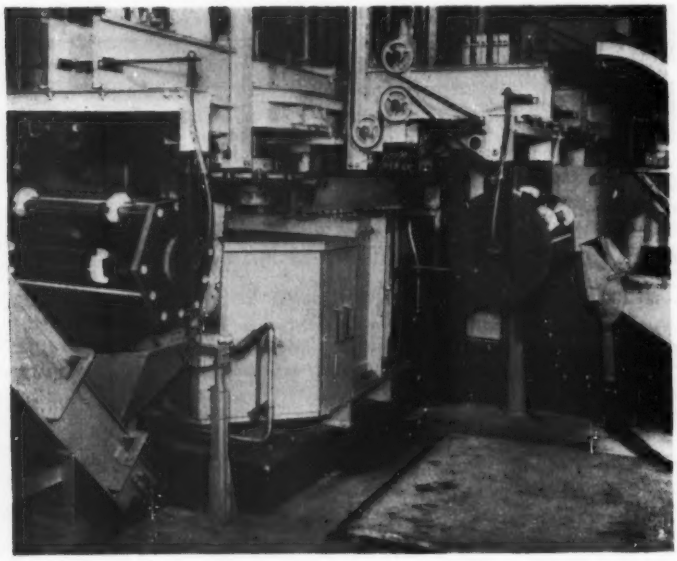


Fig. 2.—Load and Unload stations of Hanson-Van Winkle-Munning barrel plater are located together at one end of the machine. The operator can reach both barrels by taking two steps from mechanical lift which is out of picture to the right.

If the barrel is not to go into one of the solution tanks, a flag trips the switch at that station, and the carrier remains in raised position until it reaches the next station. Thus, one load may be cleaned and given a full cadmium plating while the one behind it might be only cleaned and dried. Each barrel follows its own independent cycle through the machine.

The cadmium-plating tank may be completely by-passed, or entered either at the half-way point, or the beginning. Pre-plating treatments give the operator a selection of different combinations of pickles, alkali cleaners and an acid dip, the latter with a variable immersion time. The post-plating cycle offers a selection of two different " bright " dips, each with variable immersion times.

Remote controls at the load-unload station and an electric scheduling board permit the operator to tell at a glance what is happening at any point in the cycle without leaving his station. The equipment may be started, closed down or placed at standby from the one central point.

The barrels are belt driven so the rotation rates may be changed at different stations without using heavy and expensive multiple speed motors at each barrel. Constant tension belts rotate each barrel from a gang drive on the main conveyor frame. Since the ideal tumbling rate for cleaning is different from that used in the plating solution, the drive at each station is pre-selected to give the best results.

A dryer of the hopper type tumbles the parts through two high velocity streams of hot air, and finally dumps them into their respective containers which is waiting on a roller conveyor leading to the dispatch room. Successive loads of different types may be dried in order without mixing in the four interlocked, hopper-tumblers used in the dryer. The parts are not transferred into the next hopper until it has emptied its load, thus preventing intermixed parts.

MATERIALS HANDLING

Bellevue picked a Winkle-Munning conveyor with a race-track-shaped return design. The design was selected for its advantages of compact, minimum space requirements, plus the convenience of loading and unloading stations located at the same point — to simplify routing parts.

Fig. 3.—Mechanically lifted hopper permits operator to fill barrel (bottom left) without handling or manually lifting parts. Exactly 75 sq. ft. of surface are loaded into each barrel.

Because Bellevue wanted to keep the parts flowing, the engineers decided to examine the basic principles of materials handling in the plating process. There was one man in a combination receiving-shipping room. He handled all incoming shipments, weighed them, sent them to the zinc-plating line *via* roller conveyor and then shipped them out when they were returned.

With automation, even though the new cadmium machine more than doubled the plant's capacity, both the zinc and cadmium machine could be put into operation without enlarging the despatch room staff. The first step was a floor level motorized conveyor to the cadmium plating line.

At the end of this conveyor, a mechanical lift raises the container of parts and tilts it into a storage hopper. As the parts are needed, they are released from the storage hopper into a weighing hopper, and from there directly into one of the 30 cylinders on the barrel plating conveyor.

At the end of the plating process, the cylinder is tipped into an escalator conveyor which carries the parts to the automatic dryer. When completely dried, they are automatically dumped into their container and a floor level roller conveyor returns them to the dispatch room.

The parts are not handled during the process. Nowhere along the route does the single operator of the cadmium machine touch the parts or manually lift or transfer them. All such transfers are either performed by machinery or gravity. Material received in the morning can be sent out again the same day. To get this sort of materials flow, high-speed plating is necessary.

One of the tangible benefits Bellevue has realized is an amazingly high ratio of output to man-hours. The standard output in a manual barrel plating operation is about 2 to 2½ tons of parts per man per shift. With Bellevue's cadmium line, that rate has been raised to about nine to ten tons per man. The cadmium line uses two men, one to operate the machine and the other to inspect and service.

Fig. 4.—Remote scheduling board at operator's station permits him to check condition of each stage of plating, as well as spot equipment malfunctions. Buttons permit shutting down, starting or placing the machine on standby.

Besides increasing the output, the automated system reduces the chance for human error.

One of the toughest problems was to design a machine that would operate at high speed. With existing cadmium techniques, there were no ready available machines. A high-capacity machine required a long cadmium tank, a great number of barrels, and did not speed up plating. It just kept more barrels in the solution at one time.

Fig. 5.—Dial-A-Cycle flags are set by operator on each barrel after it receives its load. These flags contact limiting switches at stations which are to be by-passed. Each barrel follows its own independent cycle. Barrels are belt-driven.

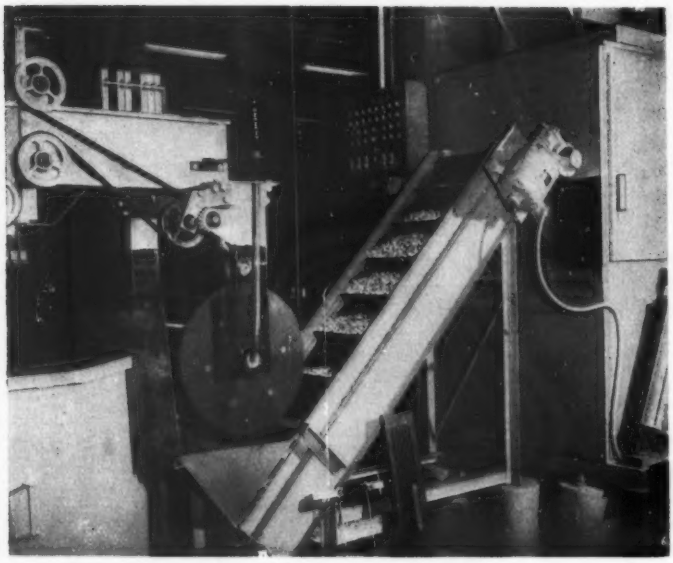


Fig. 6.—Barrel is unloaded into escalator conveyor which carries the parts into a four-hopper forced air dryer. Different batches may follow one another into dryer without intermixing. Dryer automatically unloads parts into cans waiting on a return conveyor to the shipping room.

A standard machine uses far less space with its smaller tanks, but the travel time was even slower. To speed up the machines the current density had to be increased with the danger that solutions might break down.

Shortly before Bellevue presented their problems, Winkle-Munning had been working on a cadmium bath that would stand up under higher temperatures caused by increased currents. And the additive developed-Cadalume, seemed to answer Bellevue's problem. Tests were begun at the high density levels demanded. The additive produced a clear solution which needed no break-in period, and the solution replenished by adding brightener directly to the tanks. Although usual current densities for a barrel unit are about 8 to 9 amp. per sq. ft., Bellevue uses 12 amp. per sq. ft. (about 1,000 amperes per barrel).

In spite of the high current ratio, consistent quality has been produced, without dulling or burning. The increased volume of production permits using five stations to do the work of ten, cutting unit costs and keeping overhead investment and space to a minimum.

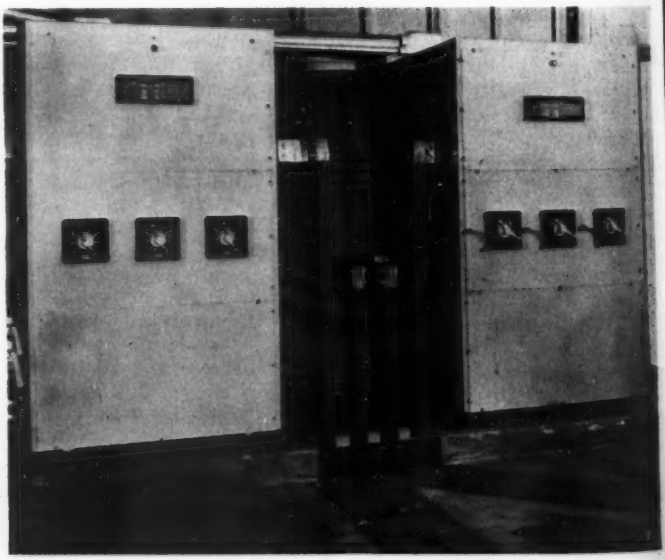


Fig. 7.—Germanium rectifiers supply high current needed for fast production work. Densities up to 13 amps. per sq. ft. are used, running to 1,000 amps per barrel. High efficiency of germanium cuts consumption cost on heavy current application.

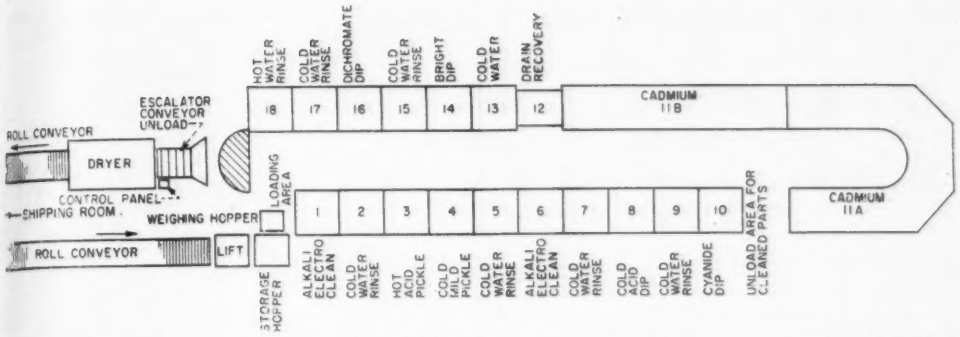


Fig. 8.—Layout of Bellevue's cadmium plating line shows how parts arrive and depart on conveyors located together at one end of the machine. Speed-up in materials handling results from elimination of storage at dispatch room and plating line.

In order to compensate for the heat produced by the increased current, 40 tons of Acme refrigerating equipment continually cool the contents of the two Cadalume tanks. The current is produced by Winkle-Munning germanium rectifiers at 10 to 18 volts. The rectifiers, with an efficiency rating of 90 to 92 per cent have a negligible ageing factor, permit higher currents at lower consumption costs.

As parts arrive at the dispatch room, weight is verified and job tickets written in accordance with a special chart. This chart was developed by actually measuring the entire surface of each part to be plated, and calculating the amount of surface area per lb. Exactly 75 sq. ft. of surface area goes into each cylinder on the machine.

The machine operator weighs each cylinder load in a hopper-scale, determining the amount from the order made up by the dispatch clerk. The order gives the weight for each load, plus the total weight of the shipment and the plating cycle.

Flags are set according to the plating instructions, and the operator can watch the entire operation on his remote scheduling board, which shows at a glance whether pumps, filters, heat exchangers, low-voltage equipment and various functional features of the conveyor are operating properly. Each light on the board has an identifying nameplate to avoid error.

A precisely interlocked system of temperature controls automatically maintains the heat of the plating solutions at a constant level from batch to batch, to give each barrel load exactly the deposit thickness required.

Keeping good men is a problem in the average plating plant, but at Bellevue, the equipment and plating area are easy to maintain and keep clean so that the skilled technicians like their work. Reduced turnover in personnel has provided a sizable saving. For a cadmium and a zinc line, including dispatch, the plant uses only five men to turn out a top output of 40 to 50 tons during a one-shift day.

Table I.
Plating Cycle

Treatment	No. of Carriers	23 Barrels* Per Hour	36 Barrels* Per Hour
LOADING	1	115	59
1. Alkali electro-clean	1	115	59
2. Cold water rinse	1	115	59
3. Hot acid pickle (this tank may be by-passed)	1	115	59
4. Cold mild pickle (this tank may be by-passed)	1	115	59
5. Cold water rinse	1	115	59
6. Alkali electro-clean	1	115	59
7. Cold water rinse	1	115	59
8. Cold acid dip (time may be varied by "delayed set-down mechanism")	1	0-115	0-59
9. Cold water rinse	1	115	59
10. Cyanide dip	1	115	59
INSPECTION OR UNLOAD	1	115	59
11. Cadmium plate (either or both cadmium tanks may be by-passed)			
a. first section	5	744	454
b. second section	5	744	454
12. Drain recovery	1	115	59
13. Cold water rinse	1	115	59
14. Bright dip (time may be varied by "delayed set-down mechanism")	1	0-115	0-59
15. Cold water rinse	1	115	59
16. Dichromate dip (time may be varied by "delayed set-down mechanism")	1	0-115	0-59
17. Cold water rinse	1	115	59
18. Hot water rinse (time may be varied by "delayed set-down mechanism")	1	0-115	0-59
UNLOAD TO DRYER HOPPER	1	115	59

* Number of seconds spent in each treatment.

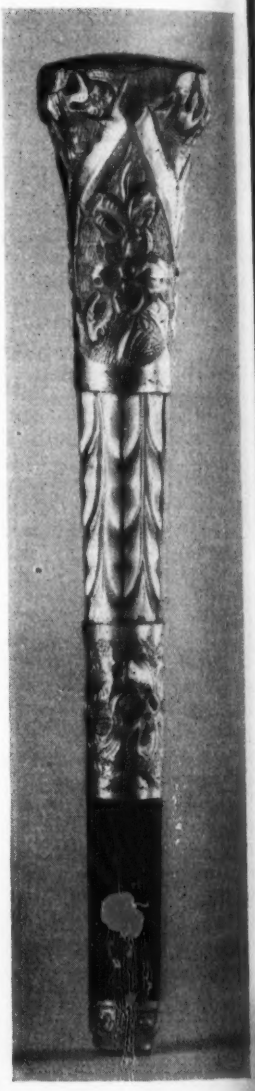
Treatment cycle

Table I indicates the amount of time spent in each station, and the number of carriers that the stations will accommodate at one time. The speeds used by Bellevue turn out 23 or 36 loads per hour, but the barrel plating machine may be adjusted to different production speeds by a timer control.

Depositing SILVER Coatings on GLASS, CERAMIC, WOOD, IVORY and similar materials

SOME NOTES ON PRACTICAL EXPERIENCE

by ELIAS SCHORE*



SILVER may be deposited on non-metallics to cover either all or part of the surface. In the case of filigree ornamentation, lead and/or silver paints are used.

The older and not so common method of plating the entire article of china or glass, for instance, with a silver coating and subsequently etching out a design is rarely if at all used today. A brief description of the method for preparing the glass and china will follow.

The article to be plated is first cleaned in a regular mild alkali and then passed through a potassium-cyanide solution. The china or glass is then rinsed and scratch-brushed. Should the physical shape of the article allow the use of sand for weight, it will be to the plater's advantage. The bottle or jug can then be filled with sand and a copper wire inserted in its neck. The wire will serve as contact. The bottle is sealed with a cork and painted with wax around its edge. It is wise to leave a long enough end to pass through all solutions and hang conveniently in the silver solution. The article is now ready for "silvering". A modified Brashear formula always works well and preparations should be made as follows :

First, dissolve 3 ounces of silver nitrate in a half gallon of water. Dissolve in another half gallon, 4 ounces of C.P. caustic potash. Finally dissolve 8 ounces of grape sugar and 1 ounce of tartaric acid in another half gallon of water. Add to this 1 ounce of absolute alcohol. Add 3 ounces of the silver-nitrate solution to 3 ounces of the caustic-potash solution. Add to this just enough ammonium hydroxide to make a clear solution. Now add 1 ounce of the grape-sugar solution to this mixture and pour over the glass or china. A silver film will now be deposited on the article. Silver strike and plating of the glass or china can now follow. A good strike solution is :

Water	1 gallon
Silver cyanide	2 ounces
Potassium cyanide	4 ounces

A good strike is followed by a silver plate. The silver bath is prepared by dissolving :

Silver cyanide	5 ounces
Potassium cyanide	7 ounces
in Water to make 1 gallon.	

The parts are then sent to the polishing department for a "cut down". They need only be smooth; no further preparation is necessary. Clean in any mild proprietary cleaner or in a soap water and ammonia solution. The parts are now ready to be painted.

Designs are painted on with asphaltum and allowed to dry. Etching may be done either in an electrolytic bath of 5 per cent nitric acid by volume using aluminium plates as cathodes, or by immersion in a solution of 1 part nitric to two to three parts of water. Celluloid and glass are prepared for depositing in the same manner.

To prepare articles like wood, horn, ivory, tortoise shell, etc. for depositing, the following method has been successfully used. Apply a coat of white shellac leaves, previously taken up in alcohol, and allow to dry over night. This coating may then be varnished by means of brushing, etc. A good varnish is prepared by dissolving 25 parts of gutta-percha in 75 parts of carbon tetrachloride. This will make a surface to which the gold-alloy graphite will adhere. Gold-alloy graphite is made by first cutting down ten pennyweight of fine gold in aqua regia, allow to cool and add alcohol and three pounds of polishing graphite. Mix well in an agate frying pan and place into an oven

*Supt. Plating Cylinder Dept., Neo-Gravure Printing Company, Weehawken, New Jersey.

for about ten minutes. After cooling, grind well in a mortar. Proprietary mixtures of the above are known and have worked well in practice.

Make a thin paste of the gold alloy with alcohol and the graphite can be applied by brush. After application, the coating should be rubbed in lightly with a polishing brush and the part is ready for silver depositing.

The most common method of silver depositing on glass and china is first to select a design and have it drawn on a sheet of paper. The design is perforated with a fine needle along its lines. The reverse side of the design is now rubbed with a piece of rock pumice using a circular motion, so as to smooth the surface. The stencil should be held pre-positioned and its surface rubbed over with either powdered chalk or talcum powder. The outline of the design is thus left on the article. A metallic paint is now applied to the design. The paint is the most important operation of the deposition. Success or failure will hinge on the proper paint and application, as will adherence to the glass or china.

To prepare a good silver powder, dissolve what has been determined to be the required amount of fine silver in one part nitric acid and two parts hot water in a large stone crock or proper vessel. When the silver has dissolved, fill the crock with hot water. To prepare the silver chloride necessary from this solution, add fine table salt. The precipitate should be allowed to settle. Now try adding a very small amount of salt and see whether any more precipitate has formed. When the liquid is clear, decant — taking care not to disturb the precipitate. Keep adding water and decanting until there is no acid reaction as tested by blue litmus paper. Now fill the crock with water and add 4 ounces of sheet zinc, which has previously been cleaned and 1-1½ fluid ounces of hydrochloric acid to each ounce of silver used.

Agitate well with a glass rod until the precipitate is metallized. This is the secret of a clear white silver paint ; then powder in enough zinc and a sufficient amount of acid to work. When the silver has metallized, remove the excess zinc and fill the crock with warm water. Allow to settle and decant. Repeat testing with blue litmus until no acid is present. Now place the silver on a gas plate and remove excess moisture. The silver may now be placed in a glass jar until ready for use.

Success in this field has been obtained with the following two formulae :

Formula 1	
Fused chloride of silver	1 ounce
Borate of lead	48 grains
Nitrate of potash	48 grains
Borax	24 grains
Formula 2	
Fused chloride of silver (as described)	1 ounce
Acetate of lead	24 grains
Soda ash	24 grains
Nitrate of potash	6 grains
Boric acid	6 grains
Borax	6 grains

Both formulae are excellent for use ; the only difference being that where formula 2 uses silver dissolved in zinc and muriatic acid, 1 uses zinc and sulphuric acid.

Materials for the paint must be carefully weighed, spirits of turpentine added, and placed into a paint grinder for about 72 hours. As the turpentine evaporates during this period, more is added. When completion of the 72 hours is near and excess turpentine is noted, open cover of the grinder and allow to evaporate. Place this into a covered glass jar and allow to stand. Pour off the oil which collects at top. In applying, the paint is put on a palette with fat oil of turpentine added to the correct consistency. Thin with turpentine or garden lavender oil.

When the design has been painted, it is allowed to dry for approximately six hours, after which it is ready for the kiln. Heats of from 600°F. to 1100°F. are used on glass, according to its own physical characteristics. Packing and firing the kiln is extremely important. Great loss in glass because of melting may be the result where the operation is not thoroughly understood. Articles will also lose their shape. The kiln must first be whitewashed and fired to burn off the impurities of the whitewash. If the firing is not done after whitewashing, discoloration of the work will result. Fire thin plates of asbestos, precut to size, at the same time. The kiln is now ready to receive the work. The hottest parts of the kiln are the top, bottom and sides. The hardest glass should be placed there and the softer in the centre. Firing will generally take between 1½ and 2 hours. The kiln is watched until the glass is red hot, after which the gas is turned off and the work allowed to cool before the kiln is opened or the glass will crack. Cooling time is generally between three and four hours. China can readily be fired for two hours without any undue precautions because it will withstand either of these amounts of heat, where glass must be watched to prevent melting. These articles are now ready for silver depositing. For contact, use a copper wire which has been plated in the silver strike. Allow a point to touch parts of the design. Plating itself should be done at low current densities, taking between twelve and twenty-four hours for a good deposit. Articles which require engraving to bring out features of the design must be plated longer. A good silver solution is prepared by dissolving six ounces of silver and using ½ to 1 ounce free cyanide per gallon. The silver as deposited must be soft and of fine grain or it will fracture. Silver depositors commonly call this "fire checks". Cracks may come out before buffing but generally they will appear after polishing. A well-balanced solution as noted with plenty of anode surface will produce a soft, velvety white deposit and be free of "checks". When the work has been plated, it is sand-buffed, cut down with tripoli, cleaned, engraved and rouge buffed as for sterling silver.

The second method for depositing on wood, horn, ivory, celluloid, tortoiseshell, etc. will now be described. Materials used are :

1 part amylacetate
1 part collodion amyl acetate
¼ part alcohol — used when thinning is necessary
1 part nitrocellulose
½ part thinner (or lacquer vehicle)

Nitrocellulose may be used to prepare wood, horn, ivory, etc. and rubber goods. After drying for 1 hour, the design may be scratch-brushed with a decorator's glass scratch brush. This tends to smooth the surface and ensure a smooth deposit. Buffing and polishing time will be greatly reduced.

Make contact to the object as described above and place in silver bath. Deposit will be heavy enough in about two to three hours for a buffing and polishing operation. Slow plating at low current densities insures optimum results.

An article made of celluloid needs no special pre-treatment. Be certain the article is clean and paint on the design as for glass. Allow it to dry for about half an hour, then softly scratch brush as above. It is now possible to wire and place the article in the silver bath. It is wise to double check contacts and be certain of good connecting points to article. It will take about two to three hours to apply sufficient silver for finishing. The polishing operations on celluloid are critical in that on heating, the celluloid will expand and cause the silver to crack away.

The silver paint for these articles is prepared by taking grain silver (approximately 5 to 10 ounces) and cut it down with C.P. nitric acid. Add a little water. When the silver has been cut down, allow the bath to cool and add two to three gallons of water. Add muriatic acid until the precipitate on the bottom is seen and the solution is clear. Allow the solution to settle for one hour and decant. Fill the crock with clean water and stir well with a stick. Allow to settle and repeat the washing several times. Add one gallon water to the precipitate. Now cut up one ounce of sheet zinc to each ounce of silver and place it into crock. Add five fluid ounces muriatic acid to the solution. Stir well and thoroughly mix until all the silver chloride has turned grey. Decant the acid solution and be sure no zinc is left in the silver chloride. Fill the crock again with clean water, stir well and allow to settle. Repeat this washing several times. Drain out water, place the chloride on a clean plate. Squeeze excess water out and place into an oven on a slow heat until it is thoroughly dried. Grind this silver chloride in a glass mortar until the silver is very smooth. Moisten the silver chloride with amyl acetate and keep it wet while grinding is being carried out. In about half an hour the silver chloride will be fine. Allow to dry and place in a well-protected jar so that heat and light will not affect it. When needed, take a small amount of the silver powder and moisten with amyl acetate. The design may be painted with this. Should it be desired, instead of cutting down fine silver, silver chloride may be used to start and one ounce sheet zinc to each ounce of silver is used. Muriatic acid is added as above and the procedure followed as before.

In general, operations for silver depositing on glass, horn, china, wood, etc. are dependent on silver paints used and conditions of silver depositing. Care and cleanliness cannot be over emphasized.

A Rational Approach to Paintshop Layout for Painting Parts of Varying Type*

by B. van der BRUGGEN †

A REGULAR production flow with extensive automation in the surface treatment of metal parts is an obvious pre-requisite for high output and production economy. Usually, this is taken as referring only to the treatment of a large production series of essentially uniform parts. The present article intends to show, however, that the same requirement can be fulfilled in the treatment of work of widely varying nature ; and will be demonstrated on the example of the paintshop layout of Sprecher & Schuh A.G., manufacturers of electrical equipment at their factories in Aaran, and Suhr, Switzerland. The surface treatment processes used in these plants was described in the February issued of METAL FINISHING JOURNAL.

Statement of the Problem

The work to be handled consisted of the following :—

Small parts, dimensions 1¼ x 1¼ x 1¼ in. upwards.
Sections (bars, etc.), up to 2 ft. long.
Panel elements, doors, walls, etc., up to 4 ft. 8 in. x 8 ft. 3 in.
Switch boxes up to 16 in. deep, of varying length and width.
Switchgear cabinets up to 2 ft. 4 in. x 8 ft. 2 in. x 8 ft. 2 in.
Special structures of varying shape and size.

An overhead conveyor was installed for handling these various pieces, enabling mechanized conveying of about 70 - 80 per cent. of the work, with individual weights ranging from 1 oz. to 88 lbs., through the plant. The remaining 20 - 30 per cent. of the work consists of exceptional size, such as large switch cabinets, bulky articles and very long sections. These are treated separately from the general processing flow by special equipment.

The following conditions were specified for the performance of the plant :

Increased output by 70 per cent., compared with the method previously in use ;
Provision for approximately 30 per cent. performance reserve, to be already considered in the project.

A further, particularly onerous condition was the use of paints and lacquers of different kinds (quality and colour shade) with different temperature and treatment requirements. This naturally influenced the travelling speed of the work and the length of the successive treatment zones, and set limits to the extended use of automation, which was, in any case, unsuitable for spraying operations. Handspraying presented particular advantages in this particular case because of ease of changing from one type of paint or lacquer to another in the case of a rapid sequence of differing pieces, or work requiring different application and stoving times. In order to ensure the essential flexibility of the installation, in addition to facilities for regulating the work in the individual sections, and careful balancing of the treatment zones, provision was made for setting-down areas. Fig. 1 shows the whole layout diagrammatically.

The flow sheet for the continuous treatment lines is :

Degreasing — washing — rinsing — pickling — drying — paint application (spraying) — stoving.

The flow in the conveyor sections is :

Loading — derusting — neutralizing — cooling — blasting — wiping or rubbing down — evaporating — cooling — unloading.

In this sequence of operations individual stages are omitted as required, the deciding factors being the condition on delivery (sheet steel with more or less heavy stains, dirt, rust, etc.), and the specified quality of the surface finish.

The time for a single passage through the line (including all stages) is at present between 40 and 100 minutes, depending on the treatment specified.

The output of pieces depends on the size and shape of the parts, and varies from 30 to 900 pieces per hour.

* The original article on which this contribution is based appeared in Industrie-Lackier-Betrieb, 25 December, 1957, pp. 331-336.
† Consulting Engineer.

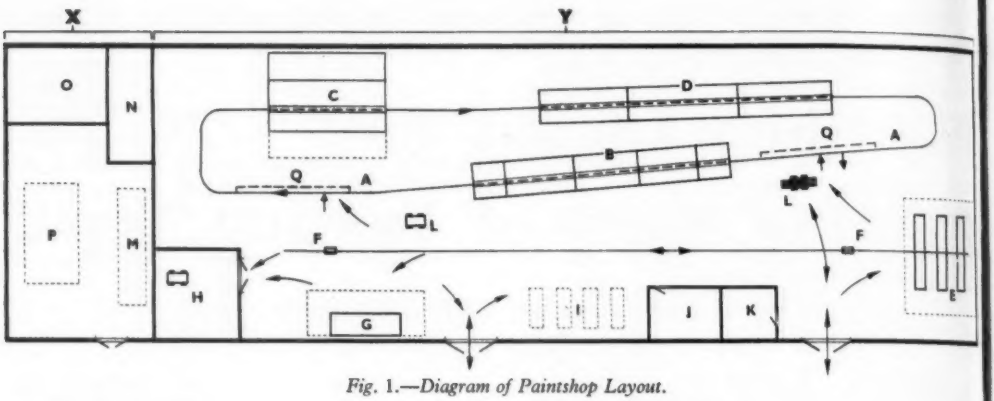


Fig. 1.—Diagram of Paintshop Layout.

X. *Production Line*

A. *Overhead conveyor.*
B. *Pressure jet tunnel (surface cleansing and pre-treatment).*
C. *Continuous paint-spraying unit.*
D. *Stoving tunnel.*
E. *Derusting plant.*
F. *Electric hoist.*
G. *Paint-spraying cubicle for large pieces.*
H. *Drying Chamber for large pieces.*

Y. *Auxiliary Service*

I. *Filling and rubbing down stations.*
J. *Paint preparation (equipment and gear store).*
K. *Shop manager's office.*
L. *Transporter trucks.*
M. *Compressed air plant.*
N. *Fresh air plant and filters.*
O. *Waste water settling tanks.*
P. *Boiler plant.*
Q. *Subsidiary operations (on the conveyor transfer sections).*

Description of the Plant

While Fig. 1 gives the general layout of the whole installation, Figs. 2 - 15 show details of the arrangements and will now be briefly commented on.

Fig. 2 shows a front view of the continuous spraying unit ; in the background, the arrangement for washing-out paint mist. This spraying station is so dimensioned that two sprays can be used together if required. The extractor and washing equipment is sufficient for this extra load. Continuous air-blast washing is also hygienically a far better solution than the solid filters used hitherto.

Fig. 3 shows parts suspended in the overhead conveyor, on their way to the spraying station. It will be seen that the mode of suspension adopted allows pieces of different size to be suitably sus-

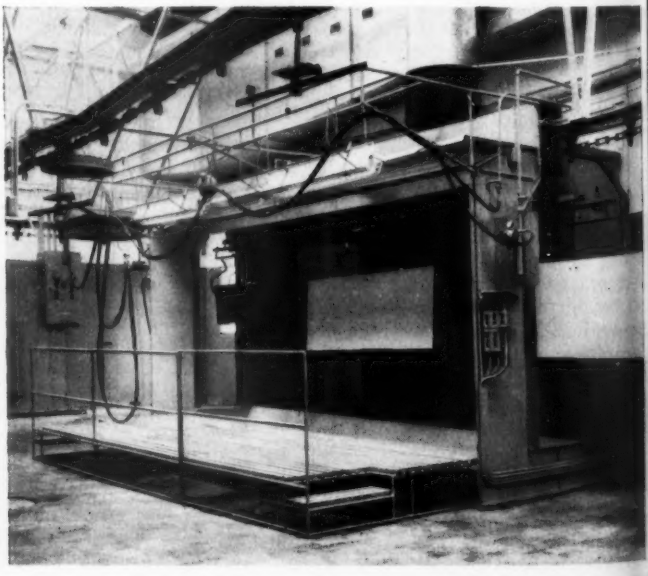


Fig. 2.—View of working opening of the spraying cubicle for manual spraying in flow production.

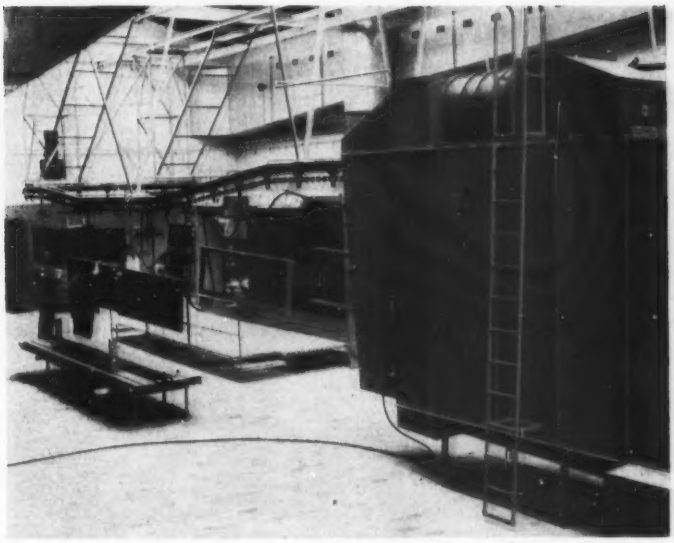


Fig. 3.—Partial view of spraying chamber and transfer sections of overhead conveyor line.

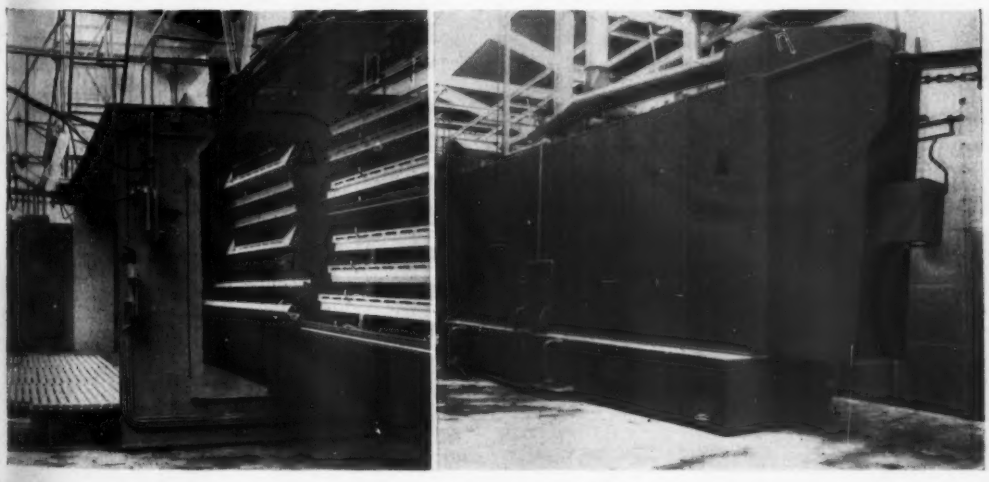
pended for treatment. The continuous spraying unit will be seen in the background.

Fig. 4 shows the exit side of the spraying station, with the conveyor passing through. Special suspension gear is provided for handling long sections, which gives them adequate support. This rigid suspension is particularly advantageous when blasting and spraying. The design of this suspension gear is one of the most important elements in such a plant. In the foreground, one of the units for extraction, air-washing and ventilating is visible. This operates by stages. The parts shown in the picture have already been lacquered, and are passing to the continuous stoving unit.

Fig. 4.—Side view of the spraying cubicle for flow production, arranged for convenient operation.

Fig. 5 represents the entry end of the installation (surface pretreatment section) which uses the pressure-jet method. The first section is for degreasing. The compact, short section has given very good results ; the method of treatment by phosphoric acid being particularly successful : under suitably-controlled conditions, it gives a firmly-keying paint foundation, without the disadvantages associated with more intensive phosphatizing treatment, *e.g.*, powdery precipitates requiring to be thoroughly brushed off, in order not to impair paint adhesion. Experience to date has shown that even very greasy and dirty surfaces can be properly cleansed. A central

Fig. 5.—Pressure jet tunnel with work entering.



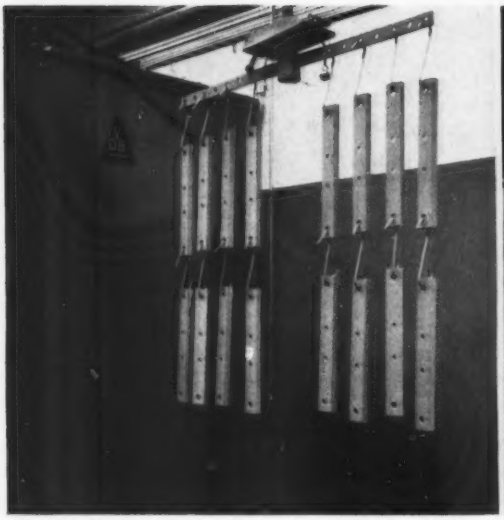


Fig. 6.—Grouping of small, freely suspended work pieces.

Fig. 7.—Spraying a panel carried on a spraying jig.

switching stand for the electric motors and the automatic valves are noteworthy.

The process constants of the solutions or washing agents (temperature, concentration, spraying pressure) are strictly controlled, according to working conditions (degree of contamination, oil proportion, shape of the work pieces). Hitherto, solution temperatures have been standardized at 65°C., and concentrations according to the medium, at 0.5 per cent. (mean values). In order that difficult shapes (very deep hollows, narrow section profiles), can be adequately processed, the need for suitable design and arrangement of the spraying elements is evident.

Contrary to the intermittent (stepwise) installations, in this case the successive operations (solution draining, surface evaporation (drying) and heating of the parts for final drying) proceed continuously. The dimensioning of the plant was based on the washing tunnel, to which all the other stages, attaching and detaching, could easily be referred. In practice, it has already been found that the time interval allowed for treatment in the tunnel includes an appreciable reserve of performance which is

Fig. 8.—Paint container and feed pipes to spraying points.

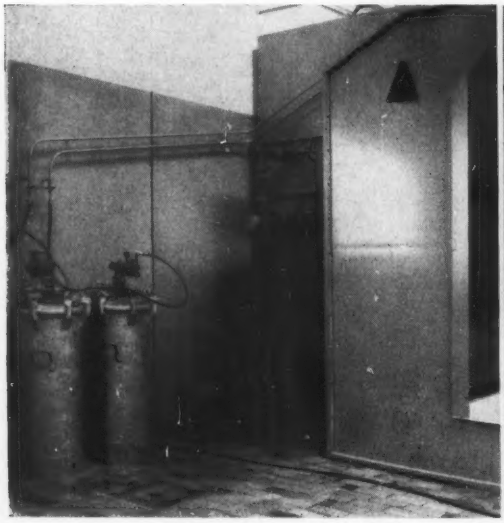


Fig. 9.—Bath for washing out paint mist.

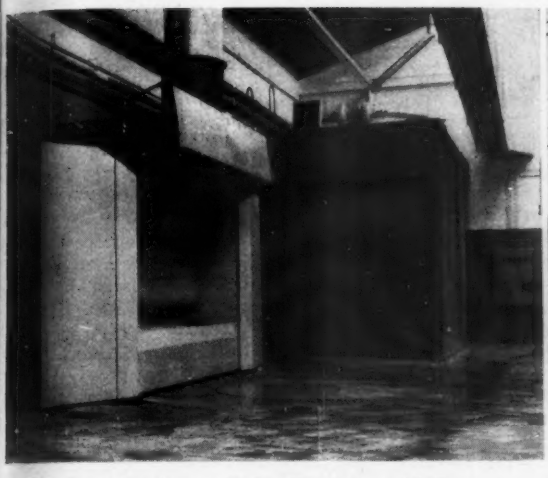


Fig. 10.—Part of equipment for handling large and bulky pieces (painting and drying).

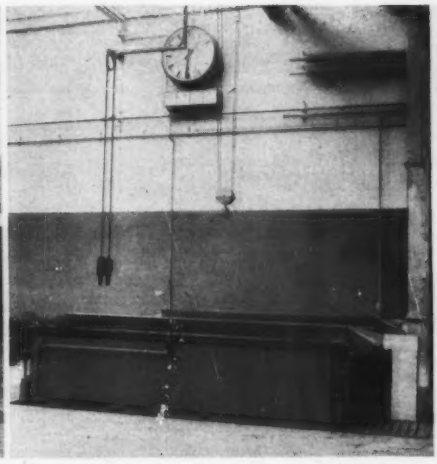


Fig. 11.—Dipping unit for treating heavily-rusted parts.

available for further improving the economy of the system. The linking of the washing tunnel with the general conveyor system of the plant has enabled the entire process to be conducted without intermediate handling between attaching and detaching.

Fig. 6 shows small parts suspended vertically. By using carrier frames or jigs, batches of 100 pieces and more can be suspended on the conveyor.

Fig. 7 shows the spraying of a work piece, suspended at a suitable working height and in the best position for draining. Fresh air and light are admitted from the back of the spraying unit ; both are controllable.

The continuous paint feed is catered for by the provision of large paint tanks. Fig. 8 shows the distributing station and the paint feed pipes. The specified viscosity for any particular paint, and its distributing pressure are controlled by suitable means ; a feature which materially assists uniform and even spraying.

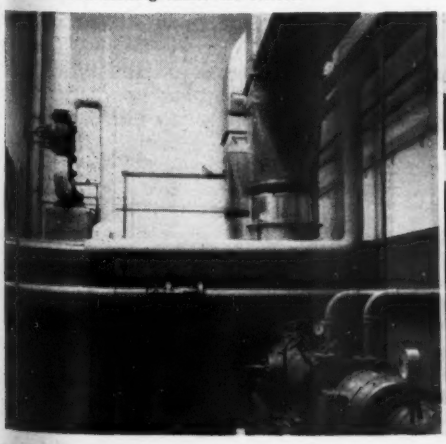
For greater convenience in servicing, the paint-mist washer (air flow washer) is arranged outside the spraying zone proper. Fig. 9 shows the corresponding arrangements.

Paint residues are regularly drained off, contributing to the general economy of the plant and making easier the periodically necessary general clean up.

Fig. 10 shows the arrangements for parts unsuitable on account of size or shape, for treatment in the continuous installation. This consists

Fig. 12.—Partial view of auxiliaries room with air compressors and ventilating plant. Heating boiler and settling tanks not visible.

Fig. 13.—One of the ventilating ducts for draughtless fresh-air supply.



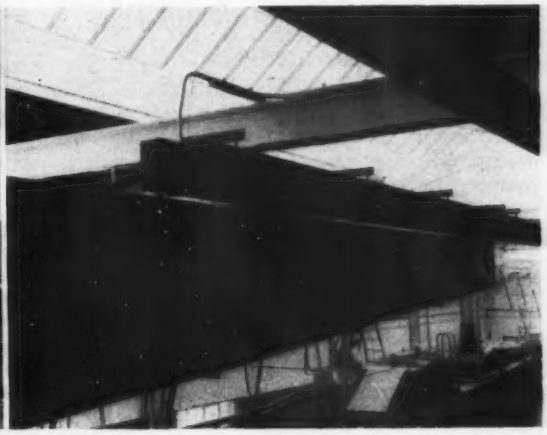


Fig. 14.—Openings of the tunnel stoving unit.

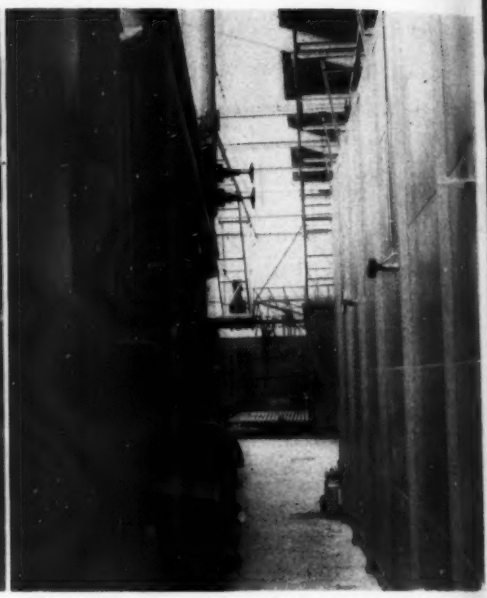


Fig. 15.—Compact and accessible installation of the tunnel units shown in Fig. 14.

essentially in addition to the rubbing-down and puttying stations, invisible on the photograph, of a spraying unit and a drying stove, of dimensions enabling parts up to 16½ ft. long to be dealt with. Heavy cabinets and cubicle structures are handled on special trucks. In view of the requirements obtaining (handling of single pieces under individually-varying conditions,) no automatic controls are used ; door interlocking, drying-time control are dispensed with. Work to be dried is charged into the stove as and when, and according to the space available. In spite of the considerable height of the spraying cubicle, temperatures are not found to vary by more than about 5°C.

The spraying cubicle with turntable fitting in the floor is shown in Fig. 10. The side walls can be swung out to receive very large pieces.

The derusting plant is shown in Fig. 11. This is principally used for sections and parts of black sheet which, in contrast to the deep-drawing quality, often has patches of rust. The plant is equipped with an electric hoist.

The working media — electric current, compressed air, fresh air, water and the arrangements for the supply and cleansing of solvents are concentrated in a separate compartment, a section of which is shown in Fig. 12. This separate arrangement also reduces noise — from compressors, oil burners and the like.

Mention should also be made of the space required for the filters and settling tanks. Fresh air, purified and heated to process temperature, is supplied through a distributing main, the tapping points on which are arranged where required. Fig. 13 shows a part of such an air duct. The discharge is upwards, producing an air circulation in the upper part of the space ; "blanketing" by hot air, which frequently occurs in summer, is thus prevented. In spite of the large volumes of air to be moved, the distributing system works practically free from draughts.

Fig. 14 shows in the foreground the mouth of the tunnel stove. This contains the radiator elements and the hot-air circulating system, the stove is additionally sub-divided into separately controllable zones. Thermostats in the control cubicle maintain any preset temperature.

Fig. 15 is a view through the plant in the direction of travel of the conveyor. The equipment units, some of which are over ten feet high, are readily accessible from above, — a feature which aids proper servicing and cleanliness.

Summary

The requirements of an installation for handling work pieces of varying kind have been completely fulfilled by the project described. The combination of a continuous installation for current work pieces of ordinary shape and size with a static installation for abnormal sizes and shapes has proved fully efficient.

RHODIUM PLATING of Commutator Segments

Use of the Dalic process improves life and performance of electric motors

A METHOD of rhodium-plating commutator segments by the Dalic* process has been developed which prolongs the life of electric motors, while at the same time eliminating radio interference and reducing power consumption. The procedure is particularly advantageous because it is fast and inexpensive, and because commutators may be treated without having to immerse the entire armature in a possibly corrosive plating solution, thus avoiding the danger of damaging the windings.

Only one major piece of equipment is needed for Dalic plating : a special rectifier with a finely graduated voltage regulator, permitting close control of the plating current. A lead from the rectifier, the cathode, is clamped to a small lathe in which the armature is rotated. The other lead has a special plating stylus, fitted with a pure graphite anode. This is wrapped in cotton, and dipped in the proper plating solution. With the current on (the output voltage for this application is 12 volts d.c.), the wet anode is swabbed over the area to be plated, and immediately highly cohesive, non-porous deposits of metal are obtained. Thickness of deposit depends directly on plating time and current, indicated precisely by a finely graduated ampere-hour meter on the rectifier. Deposits of any reasonable thickness may be obtained (see Table I) with an accuracy of ±5 per cent.

In a recent case the electric fuel pump motor of an interceptor plane was causing manufacturing delays, because it would not deliver enough fuel when drawing the maximum allowable current. It was found that the rapid formation of a copper oxide film on the commutator segments increased the contact resistance, to cause arcing, excessive brush wear, a high working temperature, and a greater power load on the aircraft. Also, after as little as 120 or 130 hours, commutator wear was noticeable.

To find a way of avoiding these losses, the commutators of one motor were rhodium-plated,

(*Continued in page* 93)

*Agents for the Dalic process in the U.K. are Metachemical Processes Ltd., 41/43 Gatwick Road, Crawley, Sussex.

Table I

Characteristics of Dalic Process Solutions and Deposits

Metal or Solution	Properties of Solutions						Characteristics of Deposits				
	Current Density, Amps./sq. ft.			Approx. Metal Content, oz./gal.	Avg. Time to Deposit 0.001 in., sec‡	Avg. Thickness in 1 min., 0.001 in.‡	Brinell Hardness	Temp. at Fusion, F	Elect. Res., per cm., —4 F	Density, gm./cm³	Present Limiting Thickness, mils
	Conventional Baths	Dalic Solutions									
		A*	B†								
Bismuth	—	700	1400	—	76.2	0.79	50§	520	115	9.8	3
Cadmium	10-50	900	5600	27	25.4	2.4	40§	610	7.7	8.7	**
Chromium	100-400	1900	3700	11	635	0.095	600	3490	14	7	0 5
Cobalt	—	700	1400	—	76.2	0.79	250	2695	9.7	8.7	5
Copper	25-250	900	5600	9.5	25.4	2.4	150	1980	1.6	8.9	**
Gallium	Non-existent	500	900	—	178	0.34	—	85	50	6	††
Germanium	—	1900	3700	—	—	—	—	1760	(300)	5.5	0.1
Gold	2-50	300	1900	12‖	76.2	0.79	100§	1940	2.4	19.3	**
Indium	20-100	900	3700	—	25.4	2.4	<1	305	8	7.3	**
Iron	20-200	900	2800	—	102	0 59	175	2790	10	7.8	1.5
Lead	5-80	900	4700	—	25-51	1 6	20§	625	19	11.3	**
Nickel	10-100	1200	4700	13	50 8	1.2	500	2645	6.7	8.9	5
Palladium	10	300	1400	—	102	0 59	150	2825	11	11.9	—
Platinum	10-120	900	2800	4.9‖	178	0.34	200	3220	10.5	21.4	5
Rhodium	10-80	1400	2800	2.4‖	1020	0.059	500	3565	5	12.4	1
Silver	5-100	700	1200	34‖	50.8	1.2	60	1760	1.6	10.5	**
Thallium	—	1400	1900	—	102	0.59	—	575	17	12	**
Tin	30-400	1400	4700	9.5	25.4	2 4	1§	445	13	7.3	15
Zinc	5-100	900	2800	13	25-51	1 6	70§	785	6	7.1	**

NOTES :

* *Not cooled or slightly air cooled.*

† *Water or refrigerant cooled anode.*

‡ *Over an area equal to that of the contact pad of the anode.*

‖ *Troy oz. per gal.*

§ *Approximate value.*

** *Infinite.*

†† *No limit metallurgically speaking, but tends to run at appreciable thickness.*

The Contribution of EFFICIENT MIXING to the EASE OF SMELTING of Vitreous Frits

The laboratory experiments reported in this technical note suggest that improvements in the ease of smelting of vitreous enamel frits could be achieved by pre-milling the batch composition.

Smelting time to clarity is reduced and the formation of "gunk" is considerably minimized.

It is believed that the techniques suggested by these experiments are capable of adaption to frit manufacture on the large scale.

Introduction

SMELTING involves the melting together of the raw materials of the batch composition. During the process the more fusible constituents such as potassium nitrate (nitre) and borax melt first, with the evolution of steam and gases which reaction agitates the batch. The metal oxides and refractories then begin to dissolve progressively as the temperature rises, until ultimately a glass is formed.

If, however, the dry ingredients of the batch are not homogeneous due to insufficient mixing or the presence or formation of aggregates of the ingredients, zones are created in which there is less dense and less viscous glass, deficient in oxides.

The effects produced are threefold :—

(a) Smelting time to clarity is increased, as mixing is now dependent upon turbulence in the smelter to bring together the fluxes, oxides, and refractories in the correct proportion for complete solution.

(b) "Gunk" is formed because agglomerates of the relatively dense titania tend to settle more quickly through the zones of less viscous glass than through a homogeneous mix of higher viscosity. In so doing the titania and other undissolved oxides build up a layer of "gunk" in the bottom of the smelter.

It is appreciated, of course, that the settling rate is reduced by the turbulence set up during the reaction, but this is not sufficient to prevent settling of agglomerates above a certain minimum size.

(c) The frit is denuded of the full share of titania, because of the "gunk" formation ; this will then contribute to variation in the brightness of the enamel.

Homogeneity of the frit can only be achieved in practice by the preparation of an intimate dry mix. Then on melting, the fluxes will cover their complement of metallic oxides and refractories, and thus expedite their complete solution. Under these conditions, the average density of the conglomerates of fluxes, metallic oxides and refractories will be similar to that of the batch ; and their rate of settling according to Stoke's Law will be a minimum.

Laboratory-Scale Experiments

To stimulate these respective conditions, a series of mixing and smelting tests were carried out in the laboratory as follows :—

Three 800-gm. lots of the batch compositions of frit 2155 (see Table I) were weighed out, using Anatase Granular.

The individual lots were mixed by :—

(a) end runner for 30 minutes, or
(b) edge runner for 30 minutes, or
(c) hand sieving through 20 B.S. mesh sieve.

Table I
Formulation for Frit 2155

Batch Composition,	per cent.	Melted Composition,	per cent.
Quartz	32.3	SiO_2	47.5
Borax	23.3	TiO_2	18.8
B.T.P. Titanium Oxide	15.1	B_2O_3	10.7
Felspar	8.9	Al_2O_3	3.0
Potassium Nitrate	13.5	ZnO	1.2
Cryolite	2.6	MgO	0.7
Zinc Oxide	1.0	K_2O	8.8
Magnesium Carbonate	0.7	Na_2O	6.5
Ammonium Dihydrogen Phosphate	2.6	P_2O_5	1.9
		F_2	1.2
	100.0		100.0

The information in this technical note from British Titan Products Co. Ltd. formed the basis of a short paper presented to the Institute of Vitreous Enamellers Conference, Brighton, October, 1956.

Fig. 1.—The mechanical equipment used to mix the batches used in the experiments described in this article were an end runner shown on the left and an edge runner shown above.

50 gm. lots of (a), (b), or (c) were charged into a 3 x 2 in. diameter No. 2 size sillimanite crucible.

The three crucibles were set symmetrically at the same depth, within a large crucible heated to 1170 ± 20°C. The heating was continued for 35 minutes.

The frits were then poured on to a mild steel plate and the crucibles, and the cast frit, were examined.

Photographs were taken of :—

(a) samples of the batch composition of frit 2155 as prepared by the mixing techniques (a), (b) or (c),

(b) the inside of the crucibles to illustrate the amount of "gunk" created from (a), (b) or (c),

(c) casts of the respective frits to illustrate their clarity.

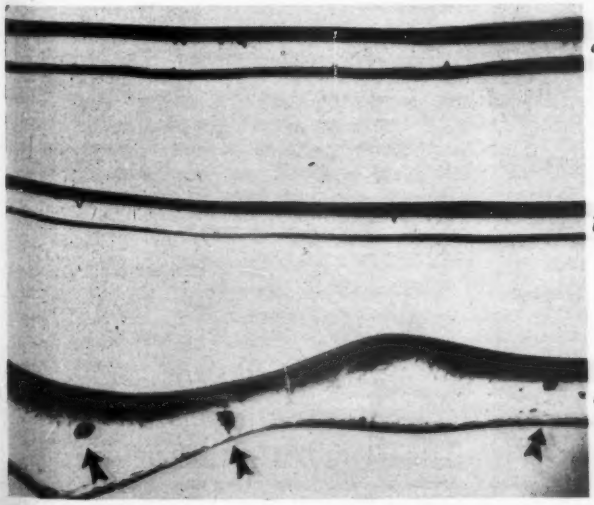


Fig. 2.—The clarity of the frit obtained from the melting of batches mixed in three different ways is illustrated on the left. a) end runner ; b) edge runner ; c) hand mixing. Undissolved TiO_2 and other constituents are indicated by the arrows in c).

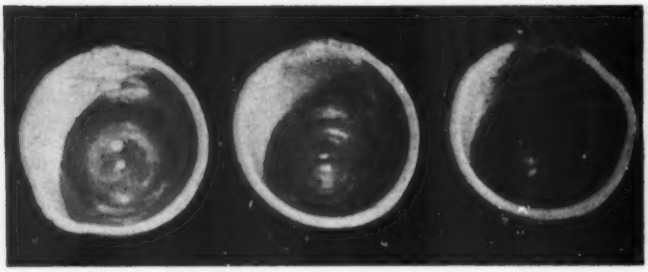


Fig. 3.—Shown here are the insides of the crucibles used for smelting the three batches. Left to right end runner; edge runner; hand mixing. The presence of "gunk" in the base of the crucible used for the hand mixed batch is obvious.

Results

Visual examination, supported by the photographs showed that :—

"Gunk" was absent in the base of the crucibles which had contained batches mixed mechanically in either the end or edge runner.

The frits prepared by the mechanical pre-mixing operation were fired to clarity.

In the case of the inefficiently mixed batch, "gunk" was obvious in the base, and on the sides of the crucible, and the frit revealed the presence of undissolved oxides.

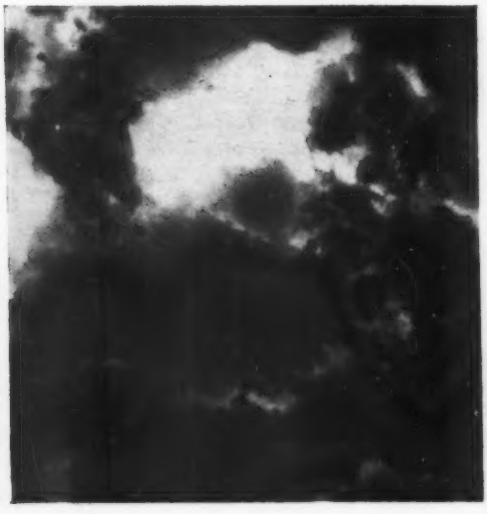
The batch produced by mechanical mixing was much more homogeneous in appearance than the hand mixed batch.

Larger-Scale Experiments

The above experiments were repeated on a slightly larger scale, using two 1-kg. lots of batch composition corresponding to frit 2155 ; one lot was mixed in the end runner the other by hand sieving. Both batches were then smelted to apparent clarity in a static crucible at 1170 ± 20°C.

(Continued in facing page).

Fig. 4.—The homogeneity of the batches after mixing and before smelting is shown in these photographs. Below left, end runner; below right, edge runner; right, hand sieve mixed. The batch mixed by hand appears far less homogeneous than do the two mechanically mixed batches.



Rhodium Plating of Commutator Segments

(*Continued from page* 89)

but not those of a duplicate control sample. Commutators in this test were 1.25 in. in diameter, and had 24 copper segments, each 0.75 in. long, with a 0.025-in. gap between adjacent bars. Thickness of rhodium deposit was 0.00005 in., although later trials revealed that half this amount would have been enough.

Improvements in performance were noted at once. Table II shows representative test results. After 385 hrs. of continuous operation, the armature current under load is up to twelve per cent less for each pump with a rhodium-plated commutator.

Some unexpected side-benefits were also discovered : (a) temperature of the plated commutators was 240°C. (464°F.), as against 300°C. (572°F.) for the unplated commutator ; (b) wear was reduced, from a former value of 0.030 in. after 168 hours, to no measurable wear after 600 hours for the plated commutator ; (c) *Radio interference was eliminated* by rhodium-plating the commutator. Formerly, interference had meant removal of a rotary converter from aircraft after about 300 hours. A Dalic plated armature allows static-free operation for several thousand hours.

In one respect, elimination of " wear " was actually a disadvantage, because it took longer to seat the carbon brushes properly — 60 hours instead of the usual 20. This problem was solved by bedding in the brushes *before* rhodium-plating the commutator segments.

To be certain that use of the Dalic plating solution would not harm the windings, two plated armatures were immersed in the rhodium electrolyte, then hung up in the test house. After three months, windings and core were undamaged ; the armatures were placed into operation without prior servicing, and functioned smoothly.

The set up required for the rhodium plating of electric motor commutators is extremely simple as can be seen from the photograph below which shows deposition in progress.

Table II

Comparative Test Results, Plated *vs* Unplated Commutators

MAXIMUM CURRENT ALLOWABLE : 25 AMP.

	Amperage at start of test	Amperage after 300 hrs.
Motor No. 1		
Unplated	23.0	25.9
Plated	23.0	22.8*
Motor No. 2		
Unplated	23.0	26.0
Plated	23.0	22.8*
Motor No. 3		
Unplated	23.0	26.0
Plated	23.0	23.5*
Motor No. 4		
Unplated	23.0	25.9
Plated	23.0	23.6*

* These values were essentially the same after 600 hrs.of continuous operation.

Contribution of Mixing to Ease of Smelting

(*Continued from page* 92).

Results

Smelting time to reach clarity — Milled batch 37 mins. — Hand sieved batch 65 mins.

Although the hand sieved batch appeared to give a clear smelt after 65 minutes, there remained in the crucible a considerable amount of " gunk," whereas the other smelt was completely free from undissolved material.

Conclusions

It can thus be concluded that :—

Inefficient dry mixing techniques give heterogeneous mixes which result in increased smelting times and formation of " gunk."

A simple pre-mixing by means of a suitable mill for a short period cuts down the smelting time by 40 per cent., and inhibits the formation of " gunk." The frit obtained will then be of greater uniformity, and will thus contribute to improved stability of brightness and colour.

Thus improved intimacy of mixing contributes to the improvement in smelting efficiency as follows :—

(a) The shorter smelting time results in both frit and material economies (as losses of the volatile constituents will be less).

(b) The furnace maintenance charge per ton of frit produced will be less, because with reduction in the firing cycle there will be more runs " per furnace life," and also the furnace life will be extended with the reduction in the amount of " gunk " formed.

(c) The complete solution of the titania will contribute to improved stability of colour and thus produce less rejects.

TWO NEW BIRMINGHAM FELLOWSHIPS

Metal Finishing included in scheme sponsored by WILMOT BREEDEN LTD.

THE inauguration of two Fellowships has been announced by the Wilmot Breeden Group of Companies, whose manufacturing interests include motor vehicle and gas turbine components, hydraulics and electronics.

These Fellowships, each worth £1,000 per annum, will be held one at the University of Birmingham and the other at the College of Technology, and will normally be held for two years.

Wilmot Breeden has for some time been engaged in building up its research and development organization. Some of its work has received relatively little attention of an academic and theoretical character ; for example, a great deal of the practice in mechanism design and in electroplating, which are two of the most important activities of the Wilmot Breeden companies, is empirical, and for its refinement demands a better understanding of fundamentals. Furthermore, the production processes in these two fields need constant study and quantitative investigation.

The company believes therefore that it should try to develop further the interest of the world of learning in its particular problems, and should try to create a group interested in these problems and specially skilled in trying to solve them.

As a Birmingham organization, the company wants particularly to develop closer relations with that part of the academic world in its own city, and it proposes in pursuance of this policy to establish a Wilmot Breeden Fellowship in association with the University of Birmingham and with the College of Technology, Birmingham. The terms of its award are arranged so that at any one time there will be a Wilmot Breeden Fellow working in association with the University and another in association with the College.

The company feels that among the great variety of people it needs, it will always want men from the Universities and men from the Colleges of Technology. The Fellowship is therefore open to people trained in both.

The conditions of award of Fellowships at the University and at the College are intended in all essentials to be the same. Consequently, there are only minor differences between the set of details below, which are appropriate to the University, and those appropriate to the College. The conditions of award will be reviewed with the University and the College authorities from time to time.

The Fellowship will be advertised every year in March, in " odd " years in association with the University, and in " even " years in association with the College, the first College appointment being made in the present year.

Details of University Fellowship

1. The value of the Wilmot Breeden Fellowship is £1,000 per annum.

2. The Wilmot Breeden Fellow will normally hold his Fellowship for two years.

3. Elections to the Fellowship are made by a Fellowship Committee of which the Chairman is the Chairman of Wilmot Breeden (Holdings) Ltd. and which includes representatives of the University.

4. A candidate for the Fellowship should normally have had two or three years' research or industrial experience. He must be acceptable to the University and would be expected to have an honours degree in a University in the British Commonwealth, a Diploma in Technology, or an equivalent qualification.

5. Appointments to the Fellowship will be made in 1959 and thereafter normally at two-yearly intervals (i.e. in 1961, 1963 and so on). Candidates must submit their applications before May 1 in a year of award, and the appointment to the Fellowship will be made by the end of June, to take effect at the beginning of September.

6. An application for a Fellowship must outline a two-year investigation or project on which the candidate seeks to work. This will be referred to briefly as the candidate's " enterprise."

7. The enterprise may be of any character likely in the opinion of the Wilmot Breeden Fellowship Committee to advance knowledge of any of the activities with which Wilmot Breeden is especially concerned. These include : Mechanisms, Electrochemistry, Metal Finishing, Metallurgy, Metal Formation, Hydraulics, Electronics. This is not an exhaustive list.

8. The enterprise must be of such a character as to require the facilities both of the company and of the University, and the time of the Fellow would be divided between the two.

9. The enterprise may have the character of scientific research, design, development, enquiry into industrial processes, operational research, a combination of some or all of these, or in some other way be appropriate to the activities of Wilmot Breeden.

(*continued in page* 96)

ELECTROLYTIC DESCALING OF TITANIUM ALLOYS

Details of a new American electrochemical process operated at room temperature

BY lowering processing costs and minimizing rejections, a new electrolytic descaling process for titanium is saving an estimated $5,000 monthly at the Temco Aircraft Corporation, Dallas, Texas. It is especially useful in removing heavy oxide deposits that are produced when titanium is heat treated without costly inert atmosphere processing facilities.

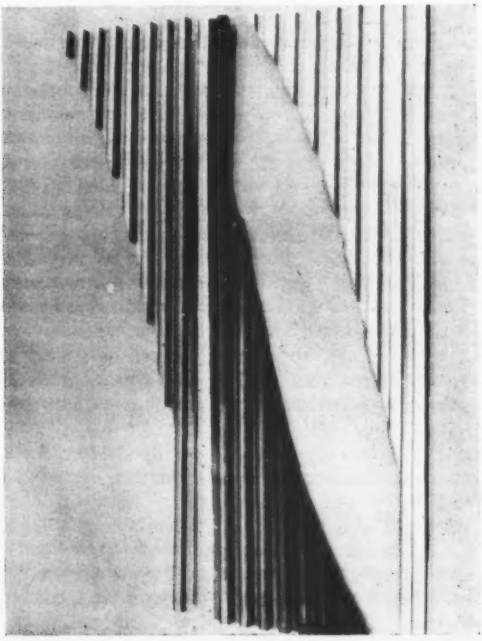
At least three methods have been used in the past for the removal of oxide scale from titanium —including immersion of the scaled titanium part in a nitric-hydrofluoric acid bath, the use of a molten salt bath, and various forms of abrasion.

Inasmuch as the action of the nitric-hydrofluoric acid bath is greatly retarded by oils, greases, stamping inks, and many other materials used during the fabrication of titanium parts, appreciable manual effort has been required before immersion. Moreover, due to variations in oxide thickness caused by uneven heating, severe etching of the titanium surfaces and a reduction in gauge thickness has occurred where no provisions were made for the short-time immersion of parts in the nitric-hydrofluoric acid bath and subsequent hand scrubbing with steel wool. Consequently, parts formed with closed angles or having portions inaccessible to hand scrubbing cannot thus be completely descaled.

The molten salt bath method involves the use of a dispersion containing salts of alkali metals, heated and maintained at a temperature above 700° F. (usually 800 to 900° F.). Close temperature control is essential, since a bath too cool

A titanium part which has been electrolytically descaled is examined on removal from the bath by J. J. Dailey (left) originator of the Temco process.

Examples of corrugated titanium aircraft components shown before (left) and after (right) descaling by the Temco process.



reduces the descaling reaction rate and a bath too hot may ignite the metal. Titanium parts descaled in the molten salt baths are customarily discoloured upon removal and require additional chemical treatment for cleaning and brightening of the metal. This chemical treatment usually consists of an immersion in a sulphuric-acid bath followed by an immersion in a nitric-hydrofluoric acid bath. The disadvantages of the molten salt bath include high original cost, high operational cost, close temperature requirements, and the necessity for further chemical treatment to obtain a satisfactory surface.

The abrasion methods for the removal of oxides (frequently employed on forgings or heavily-scaled parts) include grit or vapour blasting, and grinding. All produce a matt or scratched surface and often a discoloured appearance.

Temco's process, exclusive license for which was recently granted to Delco Chemicals, Inc., Los Angeles, is said to eliminate the main disadvantages of previous methods by completely removing oxide scale from titanium surfaces without materially reducing metal thickness or severely etching exposed component surfaces.

The process consists briefly of using a titanium article as a cathode in an electrolytic bath which may have either a ferrous metal or titanium anode (the latter being preferred). Direct current with an electromotive force of 6 to 36 volts may be passed between the anode and cathode, and the polarity of the electrodes may be reversed for periods of two or three minutes to accelerate the removal of oxides.

The electrolyte is used at ambient temperature and consists of :

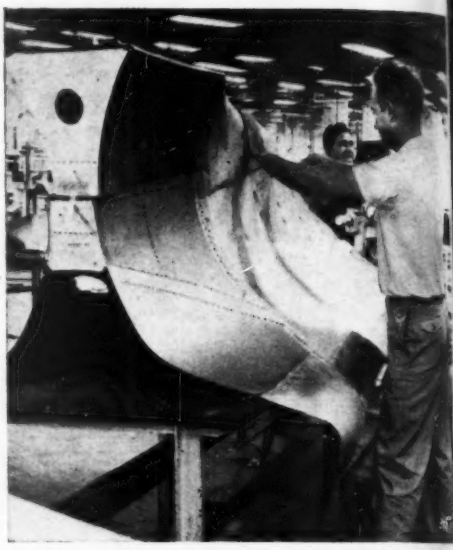
Hydrofluoric acid (48 to 70 per cent.)—1 per cent. by volume.
Nitric acid (38 to 46° Be)—4 per cent. by volume.
Sulphuric acid (60 to 66° Be)—20 per cent. by volume.
Water—75 per cent by volume.
Ferrous sulphate or Aluminium sulphate—3 to 5 oz. per gal. of other ingredients.

The time required for descaling a given titanium article is variable—depending on current density, oxide scale thickness, and bath concentration.

When a part appears to be free of scale, it is disconnected from the current source, removed from the electrolytic bath, and rinsed in running water.

Titanium parts not completely freed of scale after the running water rinse may be returned to the electrolytic bath until a clean, bright, oxide-free surface is obtained.

In addition to eliminating the need for expensive heat-processing equipment and allowing one man to accomplish tasks that formerly required the services of eight employees, Temco's process greatly reduces rejections due to uneven etching. In fact, its etching action is so delicate that machining marks are frequently visible on titanium components which have been descaled for periods up to one hour.



The new descaling process has made possible the use of titanium in place of stainless steel for these jet fighter ventral fairings with a saving of over 30 per cent in weight.

Two New Birmingham Fellowships

(*Continued from page* 94).

10. Before formally submitting an outline of his proposed enterprise a candidate is advised to arrange to visit the Wilmot Breeden organization to see at first hand the diverse kinds of work with which the Wilmot Breeden factories and laboratories are concerned, to discuss with executives the relevance of the proposed enterprise to the company's interests, and to determine the likelihood of completing it in the two-year period of the Fellowship.

11. The Fellow is required to submit to the Fellowship Committee an interim report on the progress of his enterprise at the end of his first year, and a full report after the enterprise is completed. Subject to appropriate safeguards to be determined by the Fellowship Committee, the publication of the Fellow's work will be facilitated.

12. Applications for the Fellowship and all other communications in connexion with it are to be addressed to The Secretary, Wilmot Breeden (Holdings) Ltd., Amington Road, Birmingham, 25.

Some Notes on American Experience in PLATING with *ULTRASOUND*

by Harry A. REICH*

TIME requirements can be greatly reduced, common coating defects can be avoided, normally-inaccessible areas can be finished, and even rusty or greasy parts can be satisfactorily processed are the claims made for plating with superimposed ultrasound.

The term " plating " in this instance denotes processes whereby metal coatings are deposited either with or without electricity. However, ultrasonic agitation is generally most advantageous where electroplating is done.

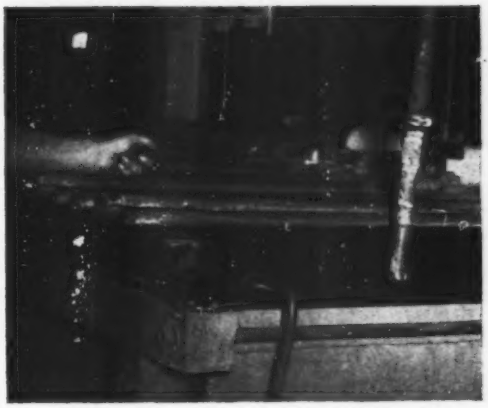
In electroless nickel plating, during which no current is employed, it has the primary advantage of saving time and improving the lustre of coatings.

Experimental evidence now available indicates that ultrasound will permit the development of many unprecedented finishing processes. But at this time of writing, it is most practical when used to improve standard procedures.

All sonic frequencies in the range above 16,000 cycles per second have certain plating potentialities. However, only those below 30,000 cycles per second are now feasible for large-scale commercial work because higher frequencies cannot be generated with adequate intensities and wave lengths with transducers which are now available.

Transducers specifically suitable for industrial plating are those of the stacked-nickel type. In such a transducer, electronic energy is converted into powerful mechanical vibrations when nickel laminae are expanded and contracted by an alternating electromagnetic field.

When dispersed in a plating solution, the ultrasonic output of a stacked-nickel transducer has the basic advantage of long wavelength. Among other things, this phenomenon permits an increase in the " throwing power " of current in an electrolyte to the point where holes and other recesses can be plated.



Evidence of the conversion of this standard plating tank to operation with superimposed vibrations of ultrasonic frequency is the coaxial cable in the centre foreground used to conduct power from a remote generator to a transducer emersed in the plating bath

Also important are cavitational effects, due to alternating pressures which occur when ultrasound is used to irradiate a solution. Because of these effects, intense " scrubbing action " is attained and unwanted gases are expelled from an electrolyte.

In electroplating, stagnant layers of electrolyte in the vicinity of electrodes have long been a recurring maintenance problem because they can retard and even halt production work. Experience in barrel plating long ago proved that mechanical

*Engineer, Electrodeposition Co., Los Angeles, Calif, U.S.A.

The parts shown on the left are typical of those plated in ultrasonically agitated baths as described in this article. Holes and recesses which would have been inaccessible under normal plating conditions received a uniform coating under ultrasonic conditions

An example of a badly "burned" coating produced by the use of a high current density in a normal plating bath. The superimposition of ultrasonic frequency agitation enabled such parts to be given a bright, sound finish at the same current density

agitation can prevent the formation of such layers.

Thanks to acoustical phenomena, which permit the efficient and uniform distribution of ultrasonic energy in a fluid, the formation of stagnant layers can now be prevented and electrodeposition can take place with optimal speed at all times.

No important changes need to be made in a plating setup in order to utilize ultrasonic agitation since an appropriate transducer is relatively small, may be located in many convenient positions on or near the bottom of a plating tank, and can be powered *via* coaxial cable with electronic equipment some distance away from the actual work area.

As a rule, the electronic generator should provide a transducer with 400 or more watts of power-depending, of course, on the size of the plating tank — in order to be effective.

The effectiveness of ultrasonic agitation in electroplating was initially demonstrated in work with a more or less conventional cadmium cyanide bath. Standard 1 x 4 in. steel strip specimens were pickled and cleaned in the usual manner, and then masked so that 1 in.-square areas could be finished — with and without agitation. Then plating was done at a current density of 250 amp. per sq. ft.

A typically "burned" coating was produced on each specimen that was plated in an unagitated solution, while a bright cadmium finish was obtained on each strip that was plated in a bath activated by ultrasound at 20 kc. per second.

Subsequent experiments have disclosed that excellent cadmium plating can be obtained with the latter agitation where current densities up to 750 amp. per sq. ft. are employed. This of course establishes the fact that ultrasound can greatly increase throwing power and the rate of plating (to about 0.6 mil. of cadmium per three minutes of processing time) by permitting the effective use of very high current densities.

At present, good cadmium plating is being produced on and in parts with threaded holes more than 1 in. deep. In addition, it has been shown that even corroded and greasy parts can be plated without preliminary cleaning due to the scrubbing action which they receive as soon as they are immersed in an ultrasonically agitated electrolyte.

There is obviously little or no point in contaminating a plating solution by using it to process parts that are consistently unclean. However, the cleaning ability of an irradiated solution is important to the extent that it minimizes rejects where parts have not been thoroughly decontaminated during degreasing and pickling operations.

It is further possible that some cleaning operations can be eliminated in electroplating shops if continuous filtration systems are used to remove contaminants from irradiated baths.

For the electrodeposition of copper and most other metals, ultrasonic agitation has substantially the same advantages as in cadmium plating.

Where high current densities have been used to accelerate silver plating in irradiated solutions, somewhat frosty coatings have been obtained. But the deposition materials were tightly bonded and could not be scratched or abraded away, even where plating rates were 15 times normal.

In the agitation of solutions for hard chrome plating, ultrasound has manifested all the advantages associated with its use in cadmium plating plus unprecedented ability to minimize material build-ups on the edges and corners of parts.

Electroless nickel plating baths, heated to 95°C., will deposit about 0.2 mils of nickel on metal parts in about 45 to 55 minutes. But when irradiated with ultrasound at 20 kc. per second, the same baths will build up 1.0 mil coatings in periods averaging 15 minutes.

Since finishes deposited by irradiated electroless solutions have exceptional brightness and lustre, it is apparent that plating speed in the latter instances is mainly the result of cavitational effects which allow superior wetting action.

ENAMELLING NEWS LETTER *from* SWEDEN

An Occasional Review of Enamelling Topics in Various Countries from "Metal Finishing Journal" Overseas Correspondents

As a forerunner to a series of vitreous enamelling news letters from Sweden, which will be published from time to time in this Journal, it is felt that a brief description of the various plants in existence is warranted.

The Swedish enamelling industry consists of some 20 plants ranging from extremely modern shops down to very small plants, where high quality sign work is carried out by the means of antiquated coal fired furnaces. Automation has made progress in many of the plants, and it is quite surprising to find that in a thinly populated country such as Sweden, 5 companies run continuous furnaces, with a possible 6 in the near future. As in the majority of countries the enamelling of sheet iron dominates over cast iron, and so is the case in Sweden. Actual figures are rather difficult to give, but is considered to be in the ratio of 65-35.

A large percentage of the works manufactures electric stoves, refrigerators, and to some extent town gas and wood burning ranges. The production of the latter two have appeared to have passed their peak years, although no doubt they will still be produced, on a diminishing scale, for a great time to come. However in addition to electric stoves there is a growing demand for specially designed bottled gas cooking appliances, which as well as being quite economical, are ideally suited to the Swedish summer houses, which are so typical of this country.

Wood burning ranges have recently had a "face lift" and many can now be seen produced, utilizing sheet steel as an outer casing, the design of which is most pleasing.

Pressed Steel Bath Tubs

Among other vitreous enamelled products manufactured in this country should be included cast iron and pressed steel bath tubs; these tubs are produced in a range of pastel shades, in addition to white. As a matter of interest Sweden is probably the home of the largest manufacturer of pressed steel bath tubs in Europe. In this country is also produced high grade steel holloware, which bears a trade name of world renown. Attractively coloured steel and cast iron holloware is very prominent in all Swedish kitchens, and the manufacturing companies, when considering new lines, often employ the services of eminent industrial designers, thus producing the most attractive and unique designs. Many of these articles are finding their way to a good market in the Western Hemisphere, and it may be worth mentioning here that at a recent exhibition held in California one Swedish company gained a high award for the excellent design and good quality enamelling of their wares.

So called contemporary colours do not appear at the moment to be popular in the kitchen of the Swedish home, in so far as ranges, stoves, and refrigerators are concerned. As a matter of fact it is interesting to note that at an exhibition held in Stockholm a short time ago, kitchen appliances finished in white were held in favour over colours when this question was investigated. After white, ivory, and cream finishes are those next in favour.

Architectural Enamelling

Architectural enamelling has also received attention in Sweden. Several buildings including petrol service stations, have over the recent years been erected employing the use of vitreous enamelled panels, which it is felt will give greater colour stability, reduced maintenance, and a finish which is as attractive as any. No doubt greater strides will take place in the near future, to utilize this finish as a building decorative, and in doing so add more colour to our town and country surroundings.

Although no actual Swedish Enamelling Association exists at the moment, there is a great deal of activity and enthusiasm in this connection, and during the past few years prominent plants have annually arranged for the various Swedish enamellers to partake in a visit of their works. On these occasions meetings have also been arranged, when technical papers have been read by leading Swedish technicians. This is a most progressive move in the history of the Swedish vitreous enamelling industry and it is hoped that this will lead to a better understanding of our industry as a whole. It is also understood that consideration is being given to holding a further conference in Sweden at some future date to which invitations will be sent out to all Scandinavian countries. If this transpires it could lead perhaps to the formation of a Scandinavian Enamelling Association.

More from Sweden in the near future.

A Productivity Service for Hot-Dip Galvanizers

Activities of the H.D.G.A.

ONE of the lessons which have come to be learned from work study and similar techniques for the improvement of productivity, is that there is no industrial process so simple that an examination of its production methods is not worth undertaking.

The basic processes involved in the production of a hot-dip galvanized coating are essentially few and uncomplicated and have not been materially altered, apart from the introduction of a few mechanical aids, since their inception. It might therefore be thought that there was little to be gained from the production point of view by a closer study of the process. That such is far from being the case is revealed by the record of the productivity service initiated in 1954 by the Hot-Dip Galvanizers Association. This service, which was started with the assistance of Conditional Aid Funds made available until mid-1956, is one of the few such projects which have been continued with finance provided from within the industry.

Although it is frequently difficult to assess in precise terms increases in productivity resulting from such studies, the galvanizing productivity service is able to cite a number of examples of how member firms are deriving benefit from its work.

For example, following the implementation of recommendations made by the Service, one company was able to report recently that with a staff of 74, only two-thirds of the number originally employed, the previous record production had been exceeded by nearly 45 per cent.

Another company, whose weekly output before and during the period of investigation had averaged 265 tons from 4 galvanizing baths, has now been able to produce over 400 tons of work in one week from only three baths.

The galvanizing department of a foundry was able to report six months after discussing the findings of a productivity investigation, an increase in production of over 40 per cent without any increase in the galvanizing teams employed.

The productivity Service, which is conducted by two fully qualified industrial engineers, carries out work study investigations for member firms, prepares publications on various aspects of productivity, arranges training courses and conferences, provides films, and operates an advisory information service. The ways in which these different functions are carried out are outlined below.

Work Study

Work Study and giving information in reply to enquiries is the major activity of the Productivity Service and to this is devoted most of the time of the industrial engineers engaged on it. Studies have already been carried out in 22 galvanizing works and detailed reports prepared and discussed with the managements concerned. Over 400 recommendations have been made in the reports, covering immediate improvements as well as long term planning.

An interesting feature of these investigations has been the use of time-lapse photography for detailed study using equipment developed by the Association's engineers, which enables factual information to be recorded for subsequent analysis.

Films

Examples of the use of time-lapse photography are included in the film "Work Study—Its Application to Team Work." This film, which was made in co-operation with the British Productivity Council, had a private showing recently and is designed to illustrate how work study can improve the efficiency of a team. It sets out to prove that even in the most modern plants work study can still point the way to further improvement. Work study techniques demonstrated in the film include activity sampling, memo-motion or time-lapse photography, and multiple activity and other types of chart. The film shows first how work study can help in the planning and re-organization of a new plant. Later sequences illustrate how it can lead to improved methods in a modern works equipped with up-to-date mechanical aids. The techniques are equally applicable to a wide range of industries, and the film will therefore be valuable to all concerned with efficiency when men work together. Particular stress is laid on the importance of keeping people informed and consulting with them so as to gain the degree of co-operation which is essential to the full achievement of the objectives of work study.

Copies of the film are available for showing from The Central Film Library, Central Office of Information, Government Building, Bromyard Avenue, London, W.3.

(*Continued on page* 102)

A New Process for REMOVING OXIDE from MOLYBDENUM

by John K. PELLOW*

A PRACTICAL method of removing oxides from molybdenum — a heat-resistant metal with a bright future in the aircraft, missile, and atomic energy industries — has been developed by the Ryan Aeronautical Company. It evolves use of two chemical baths which attack all oxides, but not the base metal.

The first bath is a dispersion containing sodium hydroxide and potassium permanganate. Its purpose is to increase the normal valency of molybdenum oxides, so that a pressure spray rinse will remove everything except a thin layer of black smut on the surface of the base metal.

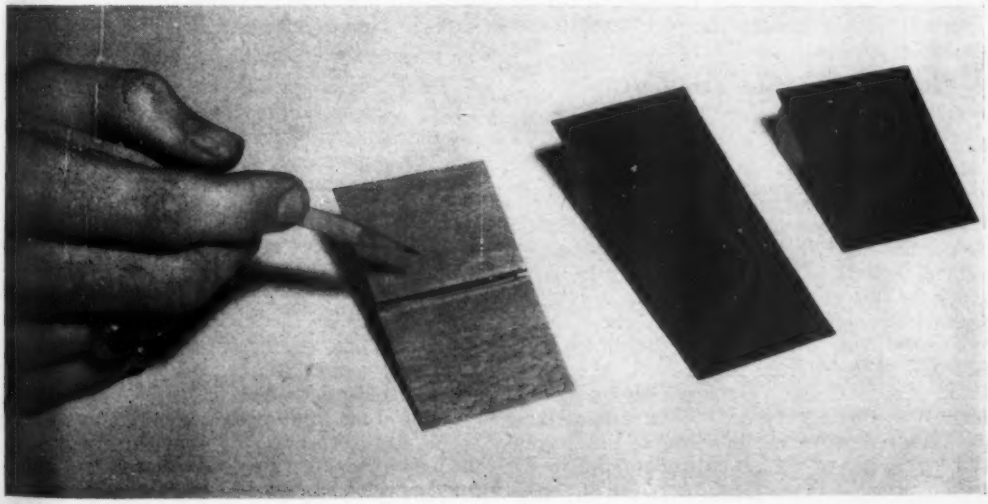
The second bath comprises acids which do not attack molybdenum, and its purpose is to remove the smut.

Older methods for cleaning molybdenum have not been satisfactory for a number of reasons. For example, a molten salt bath (containing 70 per cent. sodium hydroxide and 30 per cent. sodium nitrite and operating at a temperature of 500 to 700° F.) is not only hazardous to personnel, but must be closely controlled in order to prevent excessive losses of metal — which can amount to as many as three mils where a five-second immersion is employed.

Similarly, an anhydrous bath (containing 95 per cent. sulphuric acid, 4.5 per cent nitric acid, and 0.5 hydrofluoric acid and operated at 195° F.)

A molybdenum sheet being inserted for surface cleaning in an alkaline bath consisting of 10 per cent sodium hydroxide and 5 per cent potassium permanganate in water, at 150 - 180° F.

Samples of molybdenum sheet at various stages of surface treatment. That indicated by the pencil has received the final spray rinse. On the right it has emerged from the first bath and in the centre from the second bath.



*Ryan Aeronautical Company, San Diego, Calif.

does not always give good results because it is difficult to keep the solution anhydrous.

It is possible to clean molybdenum by mechanical means, such as sand and vapour blasting, but these procedures are quite costly and sometimes impractical due to the possibility of particle entrapment in parts with complex details.

Ryan's alkaline bath consists of 10 per cent. sodium hydroxide, 5 per cent. potassium permanganate, and 85 per cent. water by weight. It is used at 150 to 180° F., and immersion intervals may range from five to ten minutes.

The operation of this oxide-converting bath is more dependent on the concentration of sodium hydroxide than potassium permanganate, but experience to date indicates the ratio of sodium hydroxide to potassium permanganate should not be less than two to one if maximal cleaning efficiency is to be attained. The highly oxidizing manganimanganate complex which is produced by the reaction of sodium hydroxide and potassium permanganate closely resembles a complex obtained when sodium hydroxide is fused with manganese dioxide and then dissolved in water.

Ryan's smut-removing bath contains 15 per cent. sulphuric acid, 15 per cent. hydrochloric acid, 70 per cent. water and 6 to 10 per cent. (weight/volume) chromic acid. It is used at ambient temperature for immersion periods of 5 to 10 minutes, and converts residual molybdenum oxides to salt.

The new solutions have thus far been used to prepare molybdenum for fusion welding, but they are believed to be applicable wherever deoxidizing is essential to the fabrication of molybdenum.

Molybdenum has to date been principally used as an alloying element in steels. But in addition to being fairly common in the fabrication of such things as plate elements for electronic tubes and electrical heating devices, the pure metal is now becoming prominent as a structural material for gas turbines, ramjets, and rockets because of its high strength at temperatures exceeding 1600° F.

One way of removing oxides from the surface of molybdenum is by vapour blasting shown in operation here, but the very high labour costs involved renders this process uneconomic.

Despite its melting temperature of 4730° F., molybdenum oxidizes readily at temperatures above 930° F. This creates a number of fabrication problems because the metal has a transition temperature of about 400° F. and must consequently be preheated before it is worked. But following fabrication, it can usually be protected against oxidation by finishes like nickel and chromium plating so that it will retain its more desirable properties indefinitely despite prolonged exposures to extreme heat.

A Productivity Service for Hot-Dip Galvanizers

(*Continued from page* 100).

Publications

As a supplement to the practical work, the Association has planned a series of manuals on various aspects of productivity in galvanizing. Since the first of these "Productivity in Hot-Dip Galvanizing — A Study Made in the U.S.A." was issued, two further manuals have been published — "General Galvanizing — A Manual of Good Practice" and "General Galvanizing — A Manual of Costing Practice." The first of these was reviewed in last month's issue of this Journal and it is hoped to publish an authoritative review on the second in the near future.

Three further manuals are planned under the titles "General Galvanizing — A Manual of Good Housekeeping and Safety" (which is in an advanced state of preparation), "Materials Handling in the Galvanizing Industry" and "Work Study in the Galvanizing Industry."

Conferences and Training Courses

Three Conferences for Supervisors dealing not only with the practical and technical aspects on galvanizing, but also with the special problems of supervision and with many aspects of productivity have been held at Balliol College, Oxford.

For training galvanizers in work study a course was held at the Institute of Engineering Production at Birmingham University, and subsequently in the light of experience gained a second course was run by the Association staff at Pendley Manor.

FINISHING
NEWS REVIEW

METAL FINISHING CONFERENCE

Institute of Metal Finishing Choose Torquay for 1958 Meeting

SCENE of the 1955 meeting, the Palace Hotel at Torquay is to be the venue once more for the annual conference of the Institute of Metal Finishing, to be held from April 15 to 19, next.

Many members who attended in 1955 will recall with pleasure the hotel's excellent facilities and surroundings, and will welcome the opportunity of paying another visit to this attractive place.

With increasing competition for both home and overseas markets, and the ever-present need to make the most effective possible use of existing plant and equipment, the conference will provide an invaluable opportunity of ensuring the dissemination and discussion of the latest technical information on all aspects of the finishing of metals.

A full and comprehensive programme of technical papers has been planned, details of which are given below and provision has been made for visits to works of technical interest in the vicinity. There will also be ample opportunity for informal social contacts and discussion in addition to the more formal evening functions, while for the benefit of the ladies attending the conference a separate programme of entertainment has been arranged.

Programme

Tuesday, April 15. Palace Hotel
Evening—Registration and Informal Dinner.

Wednesday, April 16. Palace Hotel
9.30 a.m.—Official Opening of Conference by His Worship the Mayor of Torquay. Followed by 1*st Technical Session :*
(1) " Electro-deposited Composite Coatings," by B. B. Knapp.
(2) " Comparisons Between Different Nickel Chromium Plating Process," by G. ARNOLD.
(3) " The Properties of Bright Nickel Electrodeposits in Relation to the Period of Service of the Plating Bath," by J. EDWARDS and V. E. CARTER.
1.00 p.m.—Luncheon.
Afternoon—*2nd Technical Session :*
(4) " Bright Nickel and Levelling Power," by E. BERTORELLE, I. R. BELLOBONO and C. BORDONALI.
(5) " Stress in Nickel Electrodeposits," by T. P. HOAR and D. J. ARROWSMITH.
(6) " Surface Preparation and Porosity in Electrodeposited Nickel," by P. A. BROOK.
Evening—Reception and Dance by invitation of the Mayor and Corporation of Torquay.

Thursday, April 17. Palace Hotel
Morning—*3rd Technical Session :*
(7) " Methods of Testing Anodic Coatings on Aluminium," by A. W. BRACE and K. POCOCK.
(8) " The Production of Coloured Anodic Films Without the Use of Dyestuffs," by J. M. KAPE.
(9) " Some Aspects of the Growth of Electrodeposits," by H. J. PICK and J. WILCOCK.
1.00 p.m.—Luncheon.
Afternoon—Visit to the corrosion testing station at Brixham.

Friday, April 18. Palace Hotel
Morning—*4th Technical Session :*
(10) " Physics and Physiology of Colour Vision," by R. W. G. HUNT.
(11) " Colour and Styling," by C. NEALE. Film on Colour by I.C.I.
1.00 p.m.—Luncheon.
Afternoon—*5th Technical Session :*
(12) " The Measurement of Colour," by J. M. ADAMS.
(13) " Selection of Coloured Pigments for Industrial Finishes," by I. S. MOLL.
Evening—Reception by the President and Mrs. Hoar, followed by Conference Dinner and Dance.

Saturday, April 19
Conference Closes.
1.00 p.m.—Luncheon.

Conference Dinner and Dance

The charge for the conference dinner and dance is included in the full conference charge. Members wishing to obtain additional tickets for this function so that they can entertain guests can do so.

It will be possible to accommodate most of the delegates at the Palace Hotel, but alternative accommodation has been arranged at the Osborne Hotel, similar in standing to the Palace and situated in lovely surroundings overlooking Torbay.

All applications for accommodation will be dealt with strictly in the order in which they are received.

A supplementary programme of visits and events for the entertainment of ladies accompanying delegates is being arranged. Full details will be available at a later date.

EXTENSION TO SURREY WORKS

WITH the completion scheduled for May, work is in progress of a 5,000 sq. ft. extension to Electro-Chemical Engineering Co. Ltd's. offices at Sheerwater, near Woking, Surrey. The additional space is required for an expansion of the firm's engineering department, to accommodate extra office space, and to provide a room where technical films can be shown.

The main contractors are Hills (West Bromwich) Ltd., and the construction will be in their modular 'Presweld' system, (using a galvanized steel frame and prefabricated facing slabs, that has the advantages of speedier construction and lower initial cost.

The extension is being built eighteen months after the company's move to Sheerwater, and reflects the growing success of the company's Efco-Udylite products.

APPRENTICE PRIZE-GIVING

CHAIRMAN of the Bedfordshire County Council, Sir Frederick Mander, M.A., B.Sc., F.E.I.S., addressed an audience of distinguished visitors, parents and friends at the George Kent Ltd. annual apprentice prize-giving at Luton recently.

Stressing the importance of the apprentice to the nation, Sir Frederick said that the fact that £1,000,000 was being spent on the building of the new Luton and South Bedfordshire College of Further Education, with a third of this amount being spent on upkeep every year, was a clear indication of this.

Commander P. W. Kent, R.N., chairman and managine director of George Kent Ltd., who presided, presented the prizes. Kent's have 125 apprentices at present under training.

Aluminium Hotels

HUNGARY'S State travel agency, IBUSZ, is considering a proposal for building prefabricated hotels from aluminium to meet the expected increase in foreign visitors this year. A 60-bed, three-dormitory type hotel would cost about £6,000 at the official rate of exchange. The buildings, made of coloured sheet aluminium, can be built to any size.

PATENTS RULES AMENDMENTS

AMENDED rules making minor changes in the arrangements governing patents applications and fees came into force recently. (*Patents Rules*, 1958. H.M.S.O., 2s. 6d.)

They include the introduction of a new service to the public by which information will be supplied as to whether any particular patent is in force on payment of a nominal fee of 1s. for the first patent and 6d. for each succeeding one.

This service will replace and will, it is hoped, be an improvement on the former annual publication of the "List of Patents in Force."

Exhibition Inquiry Sequel

F.B.I. Sets up Committee

FOLLOWING on the recent survey by the Federation of British Industries of trade associations' views on the future of trade fairs in Britain (*News*, *February*), the FBI Grand Council has now approved the appointment of a committee of inquiry which will consider present exhibition facilities in this country and, if necessary, recommend plans for extending these.

The committee will consist of representatives of exhibition organisers, exhibition contractors, and prospective exhibitors. Members are Mr. George Pollitzer (chairman), chairman of Beck and Pollitzer Ltd., exhibition contractors; Mr. R. W. Boardman, director of F. W. Bridges and Sons Ltd., exhibition organisers, and Mr. W. Marrable, head of the exhibitions department, Imperial Chemical Industries Ltd.

Advice to Employers

FIFTEEN thousand employers in Britain received a booklet from the Ministry of Labour and National Service recently, with a foreword written by Labour Minister Mr. Iain Macleod, giving examples of management practices considered to be contributing to good relations in industry. In the foreword Mr. Macleod says: "Industrial efficiency . . is best achieved where workers understand the aims and plans of management and are confident that their interests are being safeguarded."

LOWER FREIGHT RATES BRING PRICES DOWN

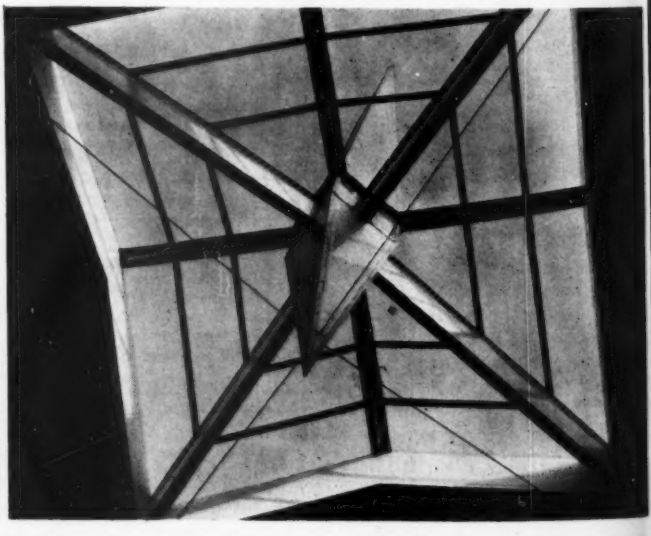
Following on the price increases for products marketed by Borax Consolidated, Ltd., Borax House, Carlisle Place, London, S.W.1, and Borax and Chemicals, Ltd., 35 Piccadilly, London, W.1, the two firms have now announced that because of a decrease in ocean freight rates, prices are to be *reduced* by 10s. per ton.

NEW CHURCH HAS ALUMINIUM SPIRE

AN unusual feature of a recently completed R.C. church at Adeyfield, Hemel Hempstead, Herts, is the aluminium-clad skylon-like spire, which projects through a central skylight both into the church below and into the sky above.

Dominating a new housing estate, the spire is clad with 20 s.w.g. Noral super-purity aluminium in the half-hard temper. The main body of the church, built by William Lacey, Hounslow, Ltd., is cruciform in plan and has a fully-supported aluminium roof, with a pitch of 17 degrees, covering an area of 3,776 sq. ft.

The roofing panels were fabricated and installed by Broderick Insulated Structures Ltd. Architects were Archard and Partners, who specified the use of aluminium because its reflective qualities, combined with the insulating board, will do much to minimize heat loss and fuel consumption.



Sprayed Metal Dust Control

Problem Posed and Answered

DURING the production of axial-flow fans, Woods of Colchester carry out a metal spraying process, using zinc and aluminium, in booths positioned in such proximity to other activities that a very high degree of dust and fume control is required.

Bag filters had been originally employed for dedusting the exhaust air from the booths, but although reasonably economical performance was attained with aluminium dust, the extremely acicular nature of zinc particles caused such a rapid increase in pressure-drop across the fabric, allied with an ability to cling even with vigorous bag shaking, that the cost of a filter installation capable of satisfying production requirements became prohibitive.

The problem was posed to Dallow, Lambert and Co., as specialists in dust control and collection, to provide a deduster capable of satisfying the requirements economically.

The solution was arrived at through two principal fields of assessment : the physical properties and behaviour of aluminium and zinc dusts, and the geographical limitations of the site.

Three methods of dedusting were considered — cyclones, fabric filters, and wet dedusters.

The collection efficiency obtainable with all three types was calculated following an accurate size analysis of the dusts involved. Cyclones were precluded by their relatively low efficiency, and fabric filters had already proved to be unacceptable for the reasons mentioned above.

A careful evaluation of wet dedusting was therefore undertaken and it was found that while the efficiency obtained with a wet deduster would not be as high as that theoretically obtainable from a fabric filter, the effluent that could be anticipated from a Dallow Lambert wet deduster would be sufficiently dilute that secondary problems of atmospheric pollution by dust and fume would be eliminated.

Critical tests were carried out in the company's pilot plant laboratory and a wet deduster Series MG type C was recommended for the Colchester works. Manual sludge removal methods were recommended because of the relatively low volume of dust entrained within the system.

The wet deduster was subsequently installed, and, following on a suggestion made by Woods, axial-flow fans of their own manufacture and design were employed in place of the normal multiblade centrifugal fan. An exceptionally neat and compact arrangement of outlet header and fans was thus obtained.

A further refinement necessary for use with aluminium metal-spray collection was the venting to free atmosphere of any incipient hydrogen generated through the immersion of the collected fine particles in water, the hydrogen concentration within the unit being kept to safe limits. A non-return valve in the air inlet duct prevents any contamination of workshop atmospheres.

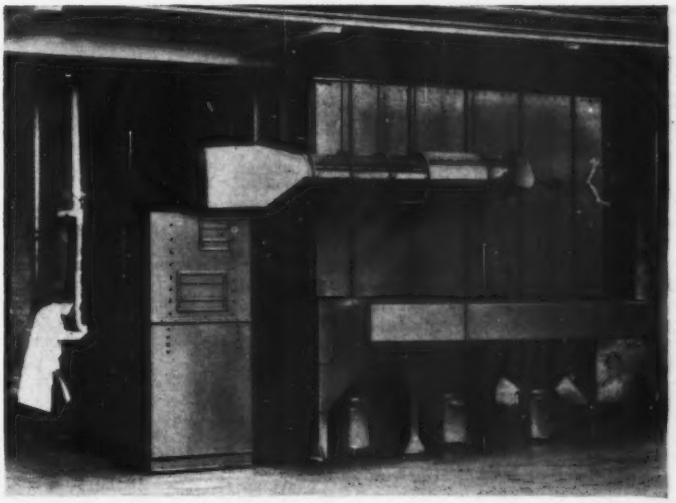
An interesting feature is that the space occupied by the wet deduster is just over 1/20th of that necessary for a fabric filter of equal capacity.

The plant has been in commission for some time now and is proving to be most satisfactory in use and in running costs. The illustration shows the wet deduster in operation.

The type 'C' unit employed is suitable where light dust loads are encountered. The tank has a flat bottom and the collected sludge is removed through well-placed sludge access doors after the water has been drained off through the primary water valve and the drain box assembly. There is little mechanical maintenance with this design and units are constructed with capacities up to 48,000 c.f.m.

The MG80 version of the series installed at Colchester has a capacity of 8,000 c.f.m. with dimensions of 8 ft. x 6½ ft. x 4 ft. (approx). It has a water capacity of 530 gallons and its gross weight is 3.8 tons.

On the left, the new wet deduster recently installed, and on the right the fabric filter unit it replaces. The saving in space can be appreciated in this comparison of the equipment



CANADIAN MOVE

THE F. J. Stokes Co. of Canada, Ltd., Canadian subsidiary of F. J. Stokes Corp. Philadelphia, U.S.A., has moved its Toronto headquarters to 4198 Dundas Street West.

Stokes are one of the largest producers of high vacuum processing equipment, plastics moulding presses, pharmaceutical machinery, and compacting presses for making powder metal parts. Mr. Fred. Y. Walters is manager of the Canadian company.

The vacuum equipment division of the Philadelphia company has opened a new sales office at 77 Bedford Street, Stamford, Conn., U.S.A. Mr. John C. Coleman will be manager of the office.

TECHNICAL *and* INDUSTRIAL APPOINTMENTS

Mr. J. W. MacMahon has been appointed general manager of the industrial lubricants division of **Wakefield-Dick Industrial Oils Ltd.**, 46, Grosvenor Street, London, W.1, in succession to Mr. R. J. Turner who has retired. Mr. MacMahon has also been appointed to the board of directors of the company.

Mr. MacMahon began his career in 1925 as an office boy in the Wakefield industrial oils department.

Mr. C. R. Woodfield, works production manager for the Wakefield Group, has also joined the Wakefield-Dick board. In addition, the company announces the following field staff appointments as regional sales managers : Messrs. C. W. Page, D. S. Kirkpatrick, F. Rogerson, and H. B. Towle.

Mr. M. Nicol has been appointed regional sales promotion manager.

* * *

A new company to fuse the copper and alloy tube, fittings and plate activities of the Yorkshire Copper Works Ltd. and of Imperial Chemical Industries Ltd. has been formed.

The new company, **Yorkshire Imperial Metals Ltd.**, disposes of assets worth about £18,000,000, including the former I.C.I. plants at Kirkby (Liverpool), Smethwick (Staffs.), Landore (Swansea), and Dundee, and the former Yorkshire Copper plants at Leeds, Barrhead (Glasgow), and Castleford (Yorks). The registered office of Yorkshire Imperial Metals Ltd. is at Haigh Park Road, Leeds. The board of directors has been constituted as follows :—

From I.C.I. : Dr. James Taylor (chairman), Peter T. Menzies, Dr. Maurice Cook, Michael J. S. Clapham, St. John Elstub, Harold Royale, and Walter N. Ismay.

From Yorkshire Copper : George P. Norton (deputy chairman), H. F. Sherbourne (managing), W. R. D. Macdonald, C. G. Robinson, Donald Fraser, J. Christie and Clifford Breckon.

The company's secretary is Mr. P. D. Peel Yates.

* * *

Mr. D. A. Hubbard has been appointed a director of Aero Research Ltd., Duxford, Cambs.

Mr. Hubbard joined Aero Research in 1939 and shortly afterwards took charge of production. In 1947 he was appointed works manager with special responsibility for the planning and commissioning of the large-scale production plants which have been erected at Duxford since then.

Mr. D. A. Hubbard

Mr. A. W. Kirton has been appointed technical representative in the south west area of the British MonoRail Ltd., Chadderton, Lancs.

Mr. Kirton, an associate member of the Institute of Materials Handling, is well-known in the mechanical handling industry. For the past five years he has been the south west area representative of the mechanical handling division of Fisher and Ludlow Ltd. and before that was a draughtsman designer with Geo. W. King Ltd., engaged principally in the design and layout of conveyor systems.

* * *

Mr. R. F. Hayman, industrial gas officer of the **Gas Council**, 1, Grosvenor Place, London, S.W.1, has been appointed chairman of the industrial gas development committee of the Council in succession to Mr. W. H. Tarn, whose term of office as chairman of the committee expired recently.

* * *

Reynolds TI Aluminium Ltd., The Adelphi, London, W.C.2, have announced the following board appointments : Sir Ivan A. R. Stedeford, K.B.E. (chairman) ; Mr. R. S. Reynolds, Jnr. (alternate chairman) ; The Lord Reith, P.C., Mr. W. G. Reynolds, Mr. J. L. Reynolds, Mr. J. H. McConnell, Mr. A. J. S. Aston, and Mr. R. D. Young.

Mr. Paul R. McGehee has been appointed chief executive (manufacturing and technical) and Mr. Basil James, chief executive (sales).

Reynolds TI Aluminium Ltd. was formed in November of last year to combine the interests and activities of Tube Investments Ltd. and the Reynolds Metals Group of the U.S.A. in the aluminium industry in the U.K.

* * *

Mr. C. P. McCallum has been appointed area manager of **Alldays and Onions Ltd.**, Sydenham Road, Small Heath, Birmingham, 11, for an area covered by Lancashire, Cheshire, Flintshire, Denbighshire, Caernarvonshire and Anglesey. Mr. McCallum has been connected with the fan industry for upwards of 30 years. His address is 18, Arnesby Avenue, Sale, Cheshire. Telephone : Sale 9509.

* * *

Mr. Ellmore C. Patterson, a vice-president of J. P. Morgan and Co., Inc., has been elected a director of **The International Nickel Co. of Canada Ltd.** Mr. Patterson is in charge of J. P. Morgan's Canadian activities.

A native of Western Springs, Ill., U.S.A., Mr. Patterson is a graduate of the University of Chicago, and has been a vice-president of J. P. Morgan and Co. since 1951. He is also a director of many American insurance companies.

Mr. L. H. Cooper, chairman of The Mond Nickel Co. Ltd. and vice-chairman of The International Nickel Co. of Canada Ltd., has been elected a director of the Canadian company.

* * *

Mr. Harold Edwards, F.R.I.C. of **John Summers and Sons Ltd.**, Shotton, Chester, has been appointed a member of the air and river pollution committee of the British Iron and Steel Federation.

* * *

The Rt. Hon. C. D. Howe, P.C., formerly Canadian Minister of Trade and Commerce, has been elected a member of the board of directors of **Aluminium Ltd.**, of Canada.

Mr. Howe's appointment to the board fills a vacancy created by the retirement of Dr. Edmund C. Harder, the company's senior geologist, after almost 40 years in the ndustry.

TECHNICAL BOOKSHELF

Hot Dip Galvanizing 1956. *Edited Proceedings of the 4th International Galvanizing Conference, Milan,* 1956 *London :* 1957. *Zinc Development Association,* 34 *Berkeley Square, London, W.*1. 223 *pp.* + *inde.. 45s.*

ALTHOUGH abstracts of some of the papers have appeared elsewhere, this is the only publication to contain all the papers and the discussions given at the Milan conference in 1956.

The book includes eleven papers contributed by authors from five countries, and the discussions which have been carefully edited are presented in a logical order together with a number of later written contributions.

Many aspects of galvanizing practice of interest to both specialist and general galvanizers are described and users of galvanized products and material will also obtain valuable guidance from the later chapters on painting and new applications. Like its predecessors, this conference report contains a subject index for easy reference to the text.

Over 200 delegates from twelve countries were present at the conference itself and their contributions to the discussion form a valuable addition to the texts of the various papers.

The first chapter ' Survey of Galvanizing Practice ' contains a paper by Mr. D. N. Fagg of the Zinc Development Association, which reviews practice in some 40 European galvanizing plants and, for purposes of comparison, four in the United States.

Chapter II, on ' The Influence of Impurities in Iron on Attack by Molten Zinc,' consists of the paper given by Dr. Dietrich Horstmann of the Max Planck Institut für Eisenforschung, Dusseldorf, who was the joint author of a paper on faults in galvanized sheet at the 1954 Oxford conference. Dr. Horstmann examines the factors which cause rapid destruction of galvanizing pots and extensive dross formation.

' Galvanizing Pot Construction ' is the subject of the third chapter in which the joint authors of the paper, Messrs. L. F. Chambers, G. R. Faulks and W. A. Jenkins of the H.D.G.A., point out that a major overhead cost in the process is the failure of the galvanizing pot.

Chapter IV entitled ' Heating Galvanizing Baths ' contains three papers. Dr. Ing. H. Wubbenhorst examines in detail the main methods of heating with special reference to recent developments in top heated baths. Mr. Gloor of the Swiss galvanizing firm, Kummler and Matter, analyses the advantages and disadvantages of electrical resistance heating compared with coal heating in plant which has been converted to the former ; Mr. Chambers of G. A. Harvey and Co. (London) Ltd. contributes a short paper on gas immersion heating using lead pockets, based on his company's experiences of this system from 1950-55.

Work study in galvanizing formed the subject of two general papers at the 1954 conference, but Mr. Northcott's paper ' The Benefits of Applying Work Study to General Galvanizing ' is the first detailed survey to be given on this particular aspect. It reviews the background and history of the H.D.G.A. Productivity Service for which he is responsible and gives a detailed account of the work study investigations undertaken and their objectives.

The galvanizing of angles, castings and wire occupies Chapter VI to VIII with papers from Switzerland, the U.K. and Belgium.

The book ends with a chapter ' New Markets for Galvanizing,' a discussion by Mr. R. L. Stubbs, director of the Zinc Development Association. He describes the work of the European General Galvanizers Association which had been formed as a result of the last conference. Apart from stimulating interest in productivity and cutting costs, work was under way to increase the applications of galvanizing. New uses for galvanizing with particular reference to the railways, coalmining, structural engineering, shipbuilding, pylons and bridges are discussed.

★★★★★★★★★★★★★★★★★★★

AVAILABLE HERE

IN last month's issue of this journal an 8-page technical paper prepared by the Sel-Rex Corpn., of Nutley, N.J., U.S.A., to describe the " Silvrex" plating process was referred to, with a note that copies could be obtained by writing direct to the U.S.A.

M. L. Alkan Ltd., Stonefield Way Victoria Road, Ruislip, Mddx., have now written to say that, as sole agents for the process in this country, they can supply this literature.

Taschenbuch für Lackierbetriebe. *Hans Weise. Hannover :* 1958. *Curt R. Vincentz Verlag.* 462 *pp.* + 138 *illustrat.*

THIS is a German pocketbook principally for use by those concerned in the varnish and lacquer industry, particularly for those interested in day-to-day operations. The scope of this book covers several technologies, most of which are expanding with great speed. Many advances have been made in the post-war period, advances that chemists and operators, in the modern varnish industry cannot afford to ignore ; unfortunately, a number of these are not mentioned. It is very much to be hoped that a number of the weaker sections will be fully revised in a future edition. If that is impossible, it would be well to change the aim and title of this publication. Chapters 2, 3, 6 and 8 are by far the best particularly those dealing with milling and mixing technique, centrifuging, electrostatic effects, high pressure pistols, modern automatic machines, infra-red/induction methods, and accident prevention devices. The book contains some useful information on baking enamels.

It is inevitable, in a book with such a general title, that the treatment should reflect the author's own work and interests. The past ten years have seen many advances of a spectacular character in the technical aspects of varnishes and lacquers, and in a great part as a result of the war time developments of plant and techniques and methods. It is a wide field to cover in a pocket book. The author is more at home in the field of the traditional methods of the industry such as milling, filtering and centrifuging. A particularly useful and stimulating chapter is that dealing with atomising and improved ventilation devices.

A striking feature is the excellence of the half-tones and other illustrations, and the text is workmanlike and pleasing, with a balance and freshness often lacking in books of this type. The book is well indexed and, provided that the language difficulty can be overcome, should be invaluable to technicians engaged in the supervision or the maintenance of industrial equipment.

E.L.

STAIRCASE OF SLOTTED ANGLE

SEVEN days before the Electrical Engineers' Exhibition is due to open at Earls Court on March 25, men will move into the exhibition hall to erect the largest staircase installation ever built from slotted angle constructional materials in this country. Planned by the Dexion company's design department at Kilburn, two identical staircase units each 35 ft. in height, will provide visitors to the show with main access between ground floor and gallery.

POTTERIES AGENCY FOR BORON PRODUCTS

THE appointment of Ralph Lawton Ltd. as agents in the Potteries for the "Three Elephant" brand boron products manufactured by Borax and Chemicals Ltd., 35, Piccadilly, London, W.1, was announced recently. From the beginning of this month, Ralph Lawton Ltd. have been working from their new address at Rose Vale, Chesterton, Newcastle, Staffs. Telephone: Newcastle Staffs 68073.

Lawton's are well established in the Potteries as millers and distributors of sands, clays and minerals.

OBITUARY

Rodway: The death occurred recently of Mr. Arthur Rodway, former Midlands representative of Borax and Chemicals Ltd., 35, Piccadilly, London, W.1.

For more than 30 years Mr. Rodway was concerned with the sale and distribution of boron products in the Midlands, South Wales and eastern counties until his retirement in 1955. He was for many years an active member of the Institute of Vitreous Enamellers and of the Society of Glass Technology until failing health prevented his attendance at their meetings. His cheerful, ever-youthful, personality gained him a host of friends in the vitreous enamel, glass and chemical industries, and in numerous other trades.

TRADE and TECHNICAL PUBLICATIONS

Two publications issued recently by Stordy Engineering Ltd., Goldthorn Hill, Wolverhampton are titled **"Industrial Ovens for Tin Printing, Varnishing and Lacquering,"** and **"Pretreatment and Finishing Plant,"** being catalogues (numbered 20 and 50 respectively) of the equipment made by the company.

Published bi-monthly by the Metallizing Engineering Co., Inc., Westbury, L.I., U.S.A., **"Metco News"** gives details of recommended practices for the metal spraying processes developed by the company. Volume 8, No. 4 lists and illustrates eight different applications of the process. The references are brief but requests for more information about any of the systems are invited.

The second issue of the **"Efco-Udylite Review"** published by the Electro-Chemical Engineering Co. Ltd., Sheerwater, Woking, Surrey, carries three articles on the technical development of the firm's products for the metal finishing industry.

The first deals with the manufacture of organic brighteners for nickel plating solutions. The second article is a description, containing a table, of Efco-Udylite solutions Nos. 4B1 and 4B1H for barrel bright nickel plating, designed to overcome certain defects inherent with other solutions.

The third article describes the No. 66 family, a series of new processes introduced by the company for use on steel, copper and brass components. A variation, No. 66H, can be used also with zinc alloy.

MEETINGS OF THE MONTH

March 17

The Institute of Vitreous Enamellers Ltd. "The Function of the Vitreous Enamel Development Council," by R. W. Holmes, at the Birmingham Exhcange and Engineering Centre. 7.30 p.m.

March 20

Institute of Sewage Purification. "The use of Ion Exchange in the Treatment of Trade Wastes," by T. V. Arden, at the Chamber of Commerce, New Street, Birmingham. 2.30 p.m.

March 21

Oil and Colour Chemists' Association (Midlands Section). "Colour and Constitution of Organic Pigments," by J. Glassman, at Regent House, St. Philip's Place, Birmingham. 6.30 p.m.

April 3

Birmingham Paint, Varnish and Lacquer Club. "Health in Paint and Varnish Manufacture," by Dr. R. Piper, at the Imperial Hotel, Temple Street, Birmingham. 7.50 p.m.

NEW COMPANIES . . .

"Ltd" is understood, also "Private Co." Figures = Capital, Names = Directors, all unless otherwise indicated.

Alco Stove Enamellers, 127/133, Ormside Street, London, S.E.15. January 13. £600. E. T. Mitchem, W. G. Fulkes, A. O. Lewis and D. A. Horner.

Edwin Longmore, Colour Works, Pitt Street, East, Burslem, Stoke-on-Trent. January 23. £2,000. To carry on bus. of manufacturers of and dealers in enamels, paints, etc. E. Longmore, E. Downward.

Northern Industrial Painters, 4, Simpson Street, Newcastle-on-Tyne, 1. January 28. £1,000. K. W. Holt and Mrs. G. Holt.

T.C. Spray Finishing Systems (Bede). February 3. £5,000. To carry on bus. of manufacturers of equipment and machinery used in connexion with application of paint, etc. Thomas Cowlard, Reginald B. Moss, Andrew E. Mantell and Jas. A. Bede.

Tomkins Plating, Littleton Street, Walsall, February 3. £1,500. Arthur H. Tomkins, Robt. W. Tomkins, Ralph H. Tomkins.

Midland Metal Finishers, Station Works, Wallingford, Berks. February 5. £1,000. To take over bus. of metal polishers carried on as "Midland Enterprise" at Crouch Street, Banbury, Oxon., etc. Edwd. C. Wallace, Sydney F. Hissett, Chas. H. R. Dowell.

Plastomer Coatings, 4/6, Browne Street, Liverpool. February 7. £2,000. To carry on bus. of manufacturers of and dealers in synthetic coatings, etc. W. G. Wedge, Alec R. Barlow, John W. Cook and Raymond T. Hampson.

From the Register compiled by Jordan & Sons Ltd, 16, Chancery Lane, London, W.C.2.

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Pocket pH Meter

A POCKET *p*H meter is now being marketed by Analytical Measurements Ltd., Dome Buildings, The Quadrant, Richmond, Surrey. The makers say that the meter simplifies *p*H determinations and provides a new tool for simple and inexpensive *p*H control (Fig. 1).

Completely self-contained with batteries in a Bakelite case, the instrument is supplied in a camera-type case, that has plastic tubs of buffer KCl solutions. Both waterproof and fungus-proof, the case has a hand and shoulder strap so that the instrument can be either slung over the shoulder or hung around the neck to leave both hands free.

The meter is scaled from 2 to 12 *p*H, and a simple adjustment gives readings from 0 to 14, with accuracy obtainable to 0.1 *p*H.

Batteries of a type used in hearing aids give sufficient power for up to 1,300 hours of operation, and the electrometer tube, switch and input connector are sealed in a single unit to ensure freedom from any difficulties that might be caused by conditions of high humidity.

Untrained personnel will find that the single knob control and continuous reading features of the instrument will greatly facilitate its use.

An interesting point is that grounded samples can be directly measured because there are no external power connections, and the instrument and electrode system are completely shielded.

Bright nickel solution

A BRIGHTENER for barrel nickel plating developed by the German firm of Schering (Berlin) is now being marketed in this country by Roto-Finish, Ltd., Mark Road, Hemel Hempstead, Herts.

The advantages claimed for the brightener are: it can be used in open or immersed barrels ; it is tolerant to variations in composition, *p*H, and temperature (of particular importance in an open-ended barrel); it possesses excellent bright throwing power and full brightness in low current density areas ; it is a single liquid brightener which is immediately soluble and requires no special control; and it possesses good ductility.

The solution permits deposition of fully bright nickel plate in short plating times. The high ductility of the deposit permits forming of the work after plating.

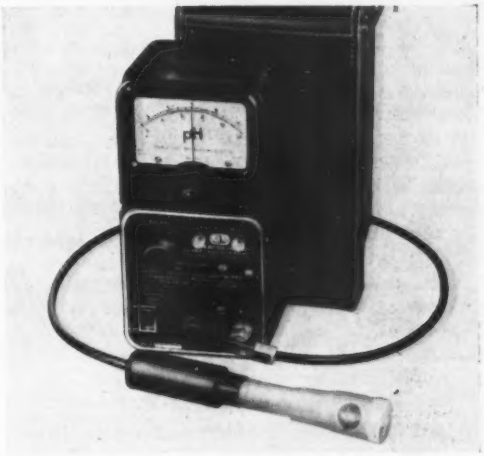


Fig. 1.—A self-contained instrument for measuring the pH of solutions.

Depending on the type and quantity of work in the barrel load, 0.25 to 0.8 mil nickel is deposited in an hour from a solution in good condition.

Special Purpose Papers

FOUR types of specialised papers, available in sheet or bulk, or in the form of " Palfsacks " multi-wall paper sacks, were announced recently by William Palfrey Ltd., Palfrey House, 24, City Road, London, E.C.1. The papers are :

Seven-O sized neutral papers : these are chemically inert papers, developed in collaboration with the U.S. Navy, for use in contact with steel, copper, tungsten, aluminium, nickel, silver, brass, manganese, zinc and cadmium. Since they have no corrosive effect, they can be used for interleaving, wrapping and storage protection for long-term or overseas requirements. They have successfully replaced many types of expensive laminated and coated barrier materials in applications where grease-resistance is not required.

Flame-resistant paper : complies with the U.S. Government non-charring standards. May be used for the protection of goods in storage, as base paper for reflective insulation, as arrestors (or filters) for paint spraying booths, as filters for warm air heating systems, as drop cloths for painters, etc.

Nevermold 101 : a mould resistant paper that

has no deleterious or corrosive effect on metals, and having a mould resistance unaffected by humidity, rain, sunlight or other climatic conditions. It is resistant to actinic degradation from ultra-violet rays, has no objectionable odour, and does not harm human skins. The paper can be used for soil and ore samples, fertilisers and peat moss, as a base paper for polythene coating, in sheet form as a ground covering for basementless houses.

Scrimtex : this is a new development in paper manufacturing, in that a fibre-glass or rayon reinforcing scrim is built into the paper during the manufacture. It is not laminated ; the paper has exceptionally high tear resistance, and tears once started cannot spread beyond the reinforcement. The paper remains relatively strong and flexible at temperatures as low as −70° F. and has been used in packaging molten resins at temperatures of up to 425° F.

Packaging machinery and advice on packaging techniques is supplied by the Thames Sack and Bag Co. Ltd., an associated company of Wm. Palfrey, Ltd.

Low-bake White Enamel

"PAR-EXEL", a new Paripan low-bake enamel containing high solid content, is now being marketed at what is claimed to be considerably less than the usual white enamel prices.

The makers, Paripan Ltd., 1 Sherwood Street, London, W.1., say that modern methods of manufacture have enabled them to reduce manufacturing costs considerably, and that "Par-Exel" is particularly adaptable to modern application techniques, including electrostatic spraying, infra-red stoving, etc. Standard convection stoving equipment — 220° to 250° F. — is used. Curing time is 20 to 40 minutes.

The product is available in 5-gallon drums only ; but free pint samples and thinners will be sent on request. "Par-Exel" is in two whites, natural white and blue-white.

Diaphragm Pumps for Chemicals

THE two models of the "Linatex" diaphragm pump illustrated in Fig. 2 have been designed and introduced to cater for those who need either a lightweight portable hand-operated unit, or a permanent motor driven pump installation.

Equally suitable for corrosive liquids, or slurries that are both abrasive and corrosive, the pumps are designed to prevent metallic contamination of the liquids inside the pump.

Both models are lined throughout with Linatex, a proprietary rubber product, and employ solid valves and diaphragms of this material. In cases where Linatex is unsuitable, chemically resistant synthetic linings can be provided. On the motor-driven pump, stroke adjustment of the crank arm is provided and needle bearings are fitted in the connecting plates. Corrosion-resistant hose connections are also provided.

With both models (pumping chemicals), a static discharge head of 25 feet is obtainable with a suction lift of 10 ft. The rate of discharge is 400 gallons per hour. The suction and discharge connections are suitable for $1\frac{1}{2}$ in. bore hose. The pumps are self-priming.

Makers are Wilkinson Rubber Linatex Ltd., Camberley, Surrey.

Cascade Sample Divider

A CASCADE sample divider, which should be a useful laboratory unit for quickly obtaining a small representative sample of bulk powder for sieve analysis of the particle size range, is now being marketed by Pascall Engineering Co., Ltd., 51, Gatwick Road, Crawley, Sussex (Fig. 3).

The unit consists of a stationary hopper mounted over a rotating cone distributor fitted to a turntable on which receiving bins are securely held by easily detachable clips. The cone and receiving bins

Fig. 2.—A diaphragm pump designed for use with chemicals. Below, the manually operated model, and right, the motor-driven version.

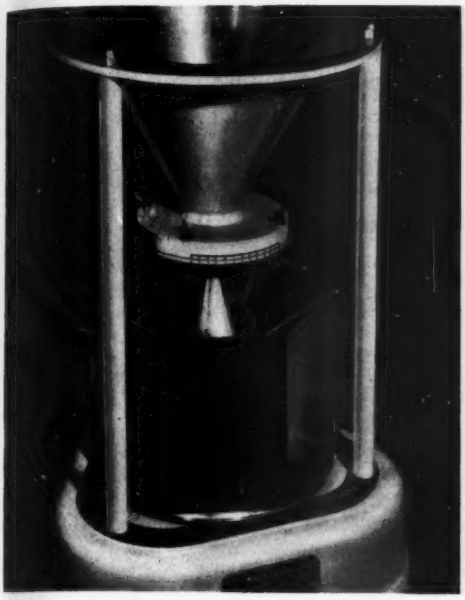


Fig. 3.—A sample divider for obtaining in the laboratory a small representative sample of bulk powder for sieve analysis.

rotate at 40 r.p.m. and the material cascades from the hopper on to the cone distributor and into six separate receiving bins, each division retaining the same proportion of particle sizes present in the bulk material. A cover for the cone and bins is provided for use with dusty materials to avoid the loss of fine particles.

The hopper has a capacity of 150 cu. in. and is equipped with a valve that allows infinitely variable control of the discharge of material to be divided.

An example of sample dividing is that in the case of material weighing 62 lb. per cu. ft. the hopper takes a 5-lb. sample and one division of this sample produces six lots of about 60 g. each.

The hopper, cone distributor, cover, turntable and base are made of aluminium alloy, and the receiving bins of stainless steel. The easily removable valve is also of stainless steel construction. The drive is by fractional h.p. motor and the whole unit, including the motor, weighs about 22 lb.

A magnetic separator

A MAGNETIC separator, available in two sizes, a 6-in. single stage drum and a 12-in. single stage drum, has now been added to the range of equipment manufactured by Roto-Finish Ltd., Mark Road, Hemel Hempstead, Herts.

The separator (Fig. 4) is designed primarily for the separation of ferrous components from the chip mass after barrelling. It has an underfeed system incorporating a stationary permanent magnet enclosed in a rotating drum of non-magnetic material. The oscillating floor of the hopper into which the work-load is fed maintains a regular flow of materials to the separating unit. The separated materials pass down two chutes for delivery to their respective hoist-pans or other containers. The one handling the ferrous components has provision for the mounting of a compact and efficient demagnetizer which fits neatly within the machine.

The smaller model has a 6-in. wide drum face, the hopper outlet door being 3-in. wide. It is driven by a ¼-h.p. electric motor, supplied complete with starter. Overall height (less snag bar) is 42½-in. and the discharge height (non-ferrous materials) is 17 in. Overall width (including hopper gate control lever) is 42 in.

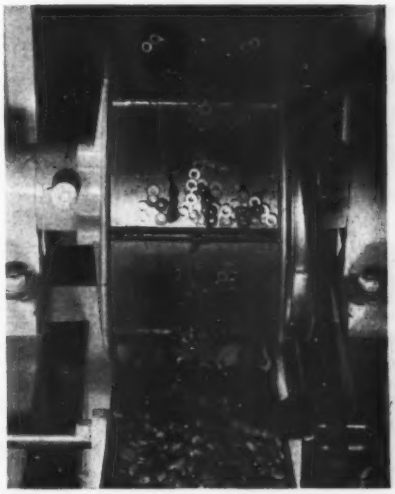
The larger model is similar except that the drum has a 12-in wide face, and the hopper outlet door and the width of the machine is proportionately greater.

Protection Tapes

A NEW cotton cloth protection tape, available in all standard widths, is being manufactured by Johnson and Johnson (G.B.) Ltd., Slough, Bucks., as an addition to the well-known "Permacel" range of industrial self adhesive tapes.

Called "Permacel" No. 35 production grade cloth tape, it offers exceptional pliability, allowing it to follow irregular radii. It has ample tensile

Fig. 4.—A machine for separating ferrous components from the chip mass after barrelling.



strength and a high hold adhesive mass enabling it to be used on a wide variety of surfaces under adverse conditions.

Although primarily a protection tape for polished and machined surfaces it is also suitable for carton strapping, sealing and reinforcing work. It will strip cleanly from polished surfaces.

The combination of the special adhesive and the winding process makes the tape easy to unreel and bestows ageing qualities over a long period of time.

Shallow-troughed Aluminium Sheeting

A NEW, aluminium corrugated sheeting has now been added to the range already produced by Northern Aluminium Co. Ltd., Banbury, Oxon. This new thin-gauge shallow-troughed sheet, (Fig. 0) is suitable for many panelling applications where flat sheet was previously used ; and the makers claim that it will provide a stiffer sheeting that also has decorated appeal (Fig. 0).

The sheeting has 1-in. wide troughs, depressed $\frac{1}{16}$ in. at pitches of 2 in., 3 in., 4 in., or 6 in. The edges parallel to the corrugations are given borders of sufficient width to provide a 1-in. overlap, and at the same time to present a continuous, symmetrical pattern across joined sheets. The overlap may be used for a variety of fixing methods and will give standard effective sheet widths of 36 in. and 48 in. Both transverse and longitudinal corrugations are available, on either plain or stucco finish sheet. The sheeting is suitable for use in vehicle bodywork generally, building and domestic equipment.

Assuming that any deflections are small, or that complete support is provided so as to prevent instability, 0.032-in. thick shallow-troughed sheeting, having a 3-in. trough pitch, provides a stiffness equivalent to 0.073-in. thick flat sheet.

Cellulose and Unplasticized P.V.C. Tapes

TWO new additions to the range of Permacel self-adhesive tapes have been announced recently by the Industrial Division of Johnson and Johnson (Great Britain) Ltd., Slough, Bucks.

Permacel No. 21 cellulose tape (transparent) and Permacel No. 51 unplasticized P.V.C. tape (transparent) have been coated with a high hold adhesive mass, and in each case the tape has been given an easy release backing which greatly reduces the unwinding tension and facilitates dispensing.

The new adhesive mass is harder than that used on the standard P20 and P50 tapes, and is designed to meet requirements for non-slip and superior adhesive qualities of tape.

These new tapes are made, in common with the standard P20 and P50 tapes, to prevent coning and splitting, and are double-bonded to overcome offsetting of the adhesive mass.

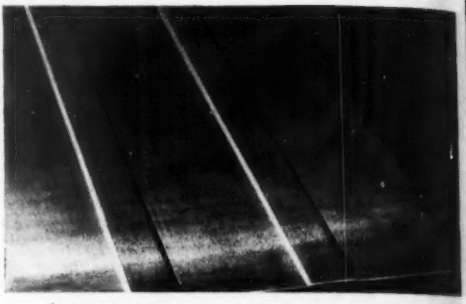


Fig.—Shallow-troughed aluminium sheet

ORGANIC ISOCYANATES

ISOCYANATES made by Imperial Chemical Industries Ltd., Millbank, London, S.W.1., are sold under the trade names " Suprasec," and four new brands — Suprasec SF, D, AC and F — now supplement and to some extent replace the established Suprasec C and DX marketed, for the first time, two or three years ago. The " Suprasec " curing agents are supplied and used with various polymeric reactants to produce lacquers, textile coatings, flexible foams, rigid foams, soft and hard rubbers, electric insulating compositions, and adhesives. These products all possess excellent physical and mechanical properties, as well as outstanding resistance to chemicals and ageing, and an additional advantage is that the products lend themselves readily to attractive coloration.

High standards of durability and resistance are set by the polyurethane coatings produced from " Daltolacs " 9, 10 and 11, used in conjunction with " Suprasecs " AC, C, DX and F. The makers claim that these coatings are outstanding in their resistance to solvents, oils, chemicals and ageing, and provide excellent wire enamels, lacquers for metal goods of all kinds, and varnishes for wood, concrete and other materials. High flexibility is an inherent characteristic of the polymer films produced and does not depend on added plasticizers. Metals such as aluminium and its alloys, sometimes difficult to coat satisfactorily, are normally trouble free with " Daltolac "/" Suprasec " lacquers. The " Daltolac " 9 lacquers are the most highly chemically resistant, and are particularly valuable for coating metal or concrete oil storage tanks and wood or concrete floors.

" Potting " compounds with excellent electrical insulating properties and high resistance to mechanical shock that can be used for supporting and immobizing delicate electronic devices in guided missiles, aircraft, radio, etc., are made from " Suprasec " isocyanates and castor oil.

Other important uses for isocyanates are in

(*Continued in page* 114)

Classified Advertisements

Prepaid rates: FIFTEEN WORDS for 7s. 6d. (minimum charge) and 4d. per word thereafter, or 24s. per inch. Box number 2s. 6d., including postage of replies.

MACHINERY FOR SALE

GUYSON SHOT BLAST UNIT for sale. Comprising compressor and dust extractor : two guns and hose : air receiver : front and side doors : sight glass overhead light : treadle pressure control. 80-150 lbs. per sq. in. Broom & Wade Compressor, 10 horse power motor drive. Extractor also motor driven. All for 400/3/50. Photo etc. from F. J. Edwards Limited, 359, Euston Road, London, N.W.1. EUSton 4681 or 41, Water Street, Birmingham 3, Central 7606.

BALL AND ROLLER BEARINGS ETC. WANTED! Also Surplus Goods — especially Hand Tools — of all descriptions. For Sale : Metal Boxes of strong and sturdy gauge and construction with handles in all sizes. Ask for details. R. Pordes, 138 New Cavendish Street, London, W.1. MUSeum 5250.

PATENT

PATENT No. 650747. " Process for shaping thin sheet metal " for sale or licence. Apply :—Chatwin & Company, Chartered Patent Agents, 253 Gray's Inn Road, London, W.C.1.

PATENT No. 746124 " Filing Machine " for sale or licence. Apply :—Chatwin & Company, Chartered Patent Agents, 253, Gray's Inn Road, London, W.C.1.

(*Continued from page* 112)

rubber-to-textile and rubber-to-metal bonding, for which purpose I.C.I. markets " Vulcabond " bonding agents, and with " Vulcaprene " synthetic rubber to produce highly efficient adhesives for leather, cellulose, wood, etc.

Curing Agent

A NEW curing agent for epoxy resins was announced recently by Furane Plastics, Inc., 4516 Brazil Street, Los Angeles 39, Ca. (U.S.A.). Colourless, it will permit the development of epoxies having high-temperature properties. Fields of application include not only high temperature tools, such as bonding jigs and fixtures for aircraft and welding equipment for metal industries, but also high temperature electrical service and maintenance functions.

When cured with appropriate epoxy resins, such as Epocast 10 at 300° F., the agent, Hardener 929, will develop heat distortion temperatures of approximately 300° F. It is particularly interesting to users of epoxy resins because it is a non-staining and colourless type of hardener, overcoming much of the objection of earlier dark coloured, staining varieties, which have been offered in the past.

Moulded PVC Fans

THE Sturtevant Engineering Co. Ltd., Cannon Street, London, E.C.4., and Acalar (1948) Ltd., Kelvin Way, Crawley, Sussex, have recently announced that they have jointly produced a range of moulded PVC fans, based on the original " Monogram " series, as an addition to the wide range of equipment manufactured by both companies for handling corrosive fumes. These fans, designed particularly to meet the need for exhausting corrosive fumes, have moulded casings and fully moulded PVC impellers, to permit high operating speeds.

At present two sizes of the fans are being made, but it is planned to increase the range in the near future. Full details can be obtained from either of the companies on request.

Hosepipe Assembly Vice

TO speed the fitting and renewal of connections to hosepipes, the Consolidated Pneumatic Tool Company, 232, Dawes Road, London, S.W.6, have introduced a new piece of equipment. The apparatus will be of particular interest in industry where connections are constantly being fitted or renewed on hosepipe.

The equipment consists of a 2⅛-in. diameter, single-acting, spring-return, cylinder with a 3-in. stroke piston, the cylinder being mounted on a baseplate with a hose clamping vice facing the cylinder and piston and mounted on the same baseplate. The two jaws of the vice are fitted with removable inserts to accommodate different diameters of hosepipe.

Air control is achieved through a single-acting hand-operated valve to which is fitted a CP air flow regulator. Sleeves are supplied for the piston rod to suit various types of hose fittings.

Operation of the unit consists of gripping the hosepipe in the vice, fitting a hose connection to the piston rod and operating the air valve. Fitting is thus carried out in a moment and experience has shown that a connection can be adequately pressed home even in a high-pressure reinforced hydraulic hose.

Where nuts are fitted to the hose clamp, a further saving of time is effected by using a small CP-344 nut runner fitted with a socket to suit the size of nut used.

Industrial Safe Aid

INTRODUCED recently by the Minnesota Mining and Manufacturing Co. Ltd., 3M House, Wigmore Street, London, W.1, is " Safety Walk," a non-slip floor coating for the workshop, factory or home.

Early production of the material at the company's Adderley Park, Birmingham, factory has been used mainly in H.M. naval vessels for treating decks, stairways, gangways and ramps — wherever the danger of slipping or falling exists, especially on wet or oil covered surfaces.

" Safety Walk," which is supplied in cleats, strips and rolls, consists of extremely hard mineral grains, surface coated to a tough fabric. These cleats or strips are unaffected by oil, petrol or weather, and tests have shown that they will stand up to years of wear.

" Safety Walk " is made in three types—' A,' ' B ' and ' D.' Type ' B ' is now the most popular, being self-adhesive and easy to apply. Type ' A ' (now self-adhesive) is best for rough surfaces such as concrete floors, or where dust or moisture cannot be entirely eliminated at time of laying. Type ' D ' is entirely non-sparking and suitable where risk of explosion or fire is present.

The product can be fixed to surfaces, indoors and outdoors, such as concrete, marble, terazzo, tiles, steel and iron plates and wood. It is supplied in colours of black, green or rust, and can be painted.

A secondary advantage is that it prevents wear of the original surface, and worn cleats can be removed and replaced without disturbance of surrounding laid areas.

Test reports from the United States, where the parent 3M company is located, indicate the excellent longevity of the material.

At an office block which takes a traffic of more than 500 people daily, " Safety Walk " installed 20 months ago is still in good condition.